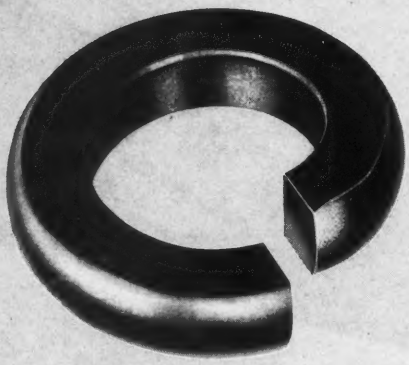
ay
ring
Mai ractice
10-12
RAIL ANTI-CREEPERS
PER RAIL
To eliminate rail creepage entirely or merely retard it, that's the question! Railways operating modern high-speed trains know rail creepage must be entirely eliminated. The standard practice of these railways is the use of 10 — 12 rail anti-creepers per rail.

Reliance HY-CROME Spring Washers



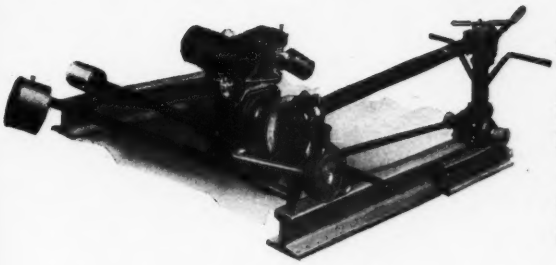
STANDARD HY-CROME
Pioneer Straight Coil
Alloy Spring Washer

● Reliance Standard HY-CROME *Spring Washers*—pioneer of straight coil round edge alloy spring washers—meet all requirements of A. R. E. A. specifications. ● Reliance Hy-Pressure HY-CROME *Spring Washers* provide increased protection from bolt looseness, in excess of the requirements of A. R. E. A. specifications—and are our latest development. The modernized HY-CROME *Spring Washer* family insures maximum spring washer efficiency for every railroad bolt requirement. HY-CROME sales engineers are interested in your bolt maintenance problems and will appreciate an opportunity to discuss them with you, without obligation.

EATON MANUFACTURING COMPANY
RELIANCE SPRING WASHER DIVISION
MASSILLON, OHIO

Streamliner *"City of San Francisco"*
SOUTHERN PACIFIC COMPANY
San Francisco to Chicago in 39 hours, 45 minutes

Raco Power Track Machine

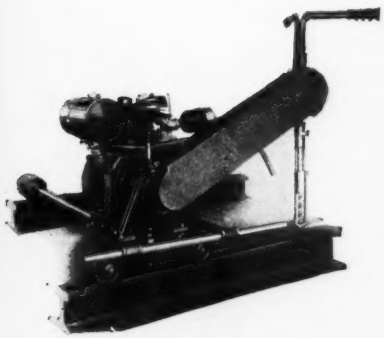


Over 300 on 50 railroads have established remarkable records for economy.

Ease of operation, light weight, automobile type construction **insure maximum speed and minimum service interruptions.**

Tightening out-of-face with the Raco lasts several times as long as hand tightening and insures **uniform tension on all bolts.**

Raco Tie Boring Machine



Bores holes for **screw** spikes or **cut** spikes.

Bores ties in track more than **twice as fast** as any other accepted means.

Bores holes **absolutely vertical.**

Locates all holes **exactly in center** of tie plate punching.

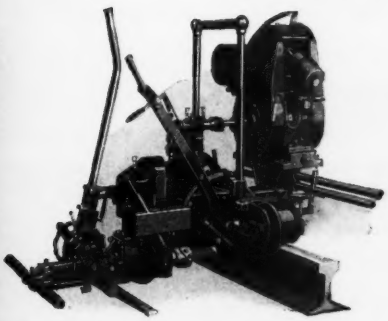
Automatically **controls depth** of hole.

Chips are blown away as fast as made, leaving hole clear.

One-man operation.

Machine can be removed from track by one man.

Everett Power M-W Machine



For ten years the Everett M-W has been the **standard** power rail drill on practically all railroads.

Its design and construction insure the utmost in facility of operation and in speed and accuracy of adjustment.

It has made such astonishing records for economy that **no road can afford to use any other means for drilling bolt holes.**

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE

405 LEXINGTON AVENUE

(Chrysler Building)

NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Here's the combination that crossings need today

THE fast-rolling traffic of these days calls for two qualities in crossings—hardness to stand the battering, and resilience to dissipate the shock of wheel impacts.

The Bethlehem Heat-Treated Crossing has both of these characteristics highly developed. Its type of construction supplies the resilience. The heat-treated rolled-steel rails provide the hardness. They have an average Brinell of 361 compared with an average of 282 for ordinary rail steel and initial hardness of about 225 for the solid-manganese crossing.

Results where these crossings have been installed indicate that they wear less than half as rapidly as manganese-steel crossings.

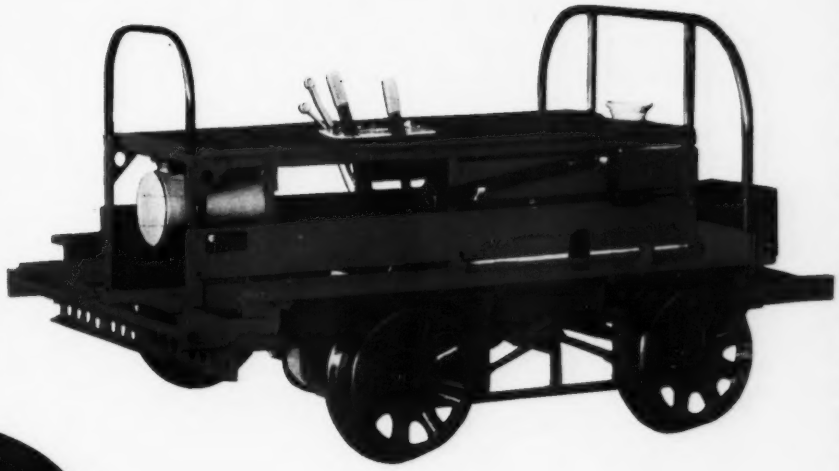
BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

LARGE CAPACITY

LIGHT WEIGHT

SIMPLIFIED MAINTENANCE

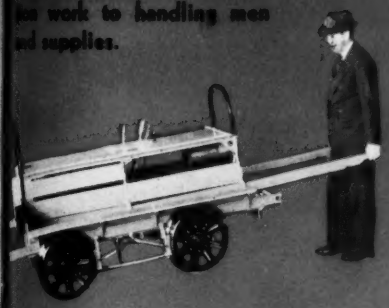


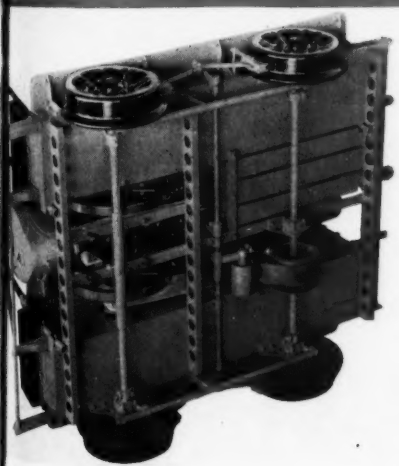
Performance ON THE JOB COUNTS

Fairmont S2-SERIES E

Here is a car that will save money for your road all year. In winter the new Fairmont S2 Series E can be used for daily track inspection; for it is light enough to be removed from the track by *one* man. In summer, this powerful car will handle the heaviest jobs on your largest "standard" sections. Its Fairmont QBC engine has ample power and good speeds for all average section requirements in handling of trailers and material. The power is evenly and smoothly applied through Fairmont's famous Timken bearing-controlled endless cord belt drive. In keeping with traditional Fairmont design all parts of the S2 car are readily accessible. Quality parts throughout reduce maintenance costs to the minimum. Fairmont Railway Motors, Inc., Fairmont, Minn.

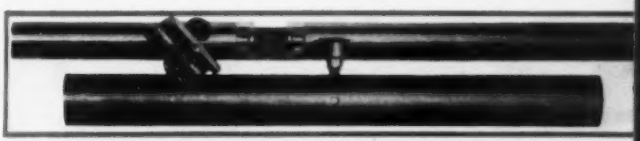
The full-size section car that one man can handle. The Fairmont S2 Series E can be used on all jobs from inspection work to handling men and supplies.

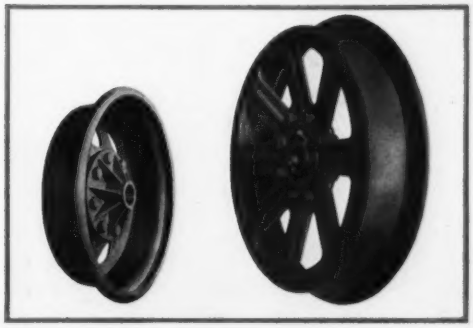


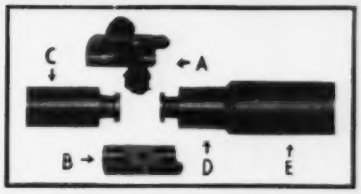


Note the light sturdy frame. Cross members are aircraft-type channels.

(below) Fairmont Demountable Wheels simplify maintenance. 16" wheels are standard. 14" wheels can be furnished if preferred.





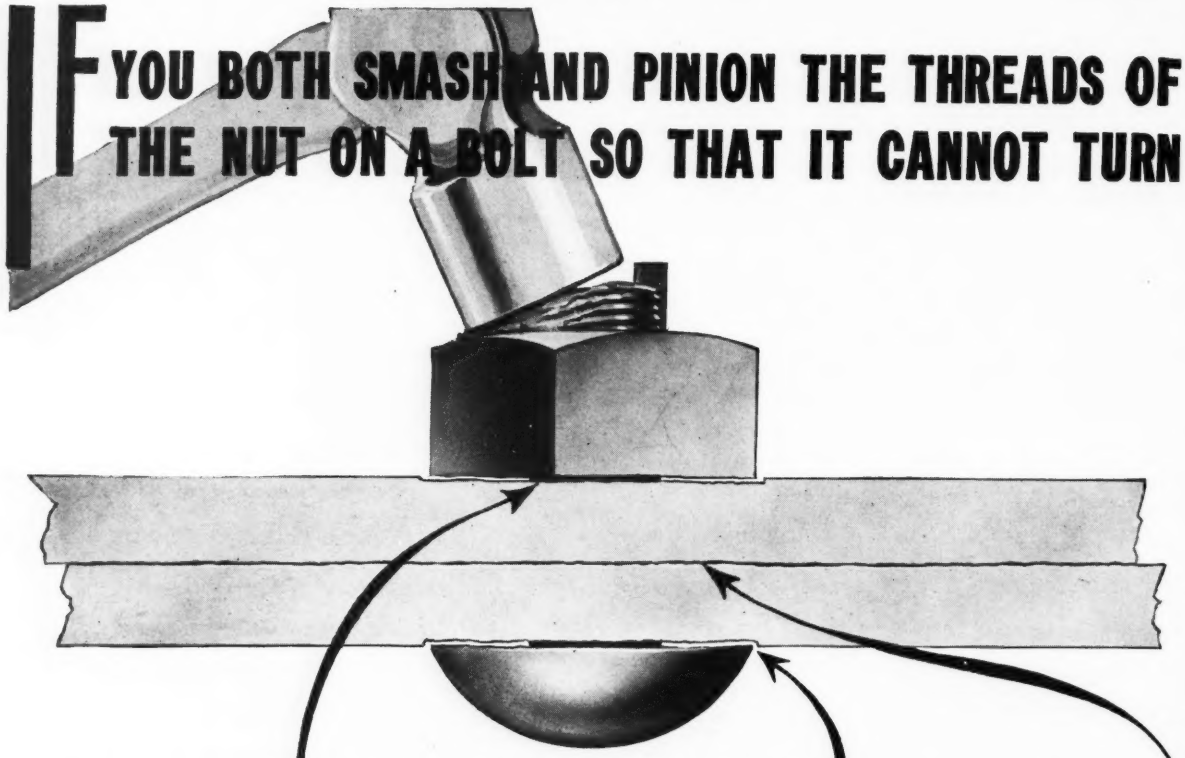


For greater safety and more economical upkeep, the S2 has a *differential* front axle instead of the usual troublesome loose wheel. Above is the axle before assembly. The outline view shows its simplified construction—A and B upper and lower sections of bronze center connection, C and D, inner ends of the two halves of the axle, and E, the steel axle sleeve.

OF ALL THE CARS IN SERVICE TODAY

MORE THAN HALF ARE FAIRMONTS

IF YOU BOTH SMASH AND PINION THE THREADS OF THE NUT ON A BOLT SO THAT IT CANNOT TURN



... then you cannot tighten the nut down when inevitable wear loosens the parts

HERE *and* **HERE** *and* **HERE**

1
IMPROVED HIPOWER

2
DOUBLE HIPOWER

3
NATIONAL RIB WASHER

4
ANKOR HIPOWER

5
NATIONAL COLLAR GROOVED

6
THACKERAY SPRING WASHER

ONLY A SPRING WASHER CAN COMPENSATE FOR SUCH WEAR BY EXPANDING AND MAINTAINING BOLT TENSION UNTIL THE TRACK MAN COMES AGAIN, *only a spring washer!*

That is why Hipower Spring Washers more than pay for themselves in reduced upkeep costs—less labor and maintenance—fewer renewals and repairs.

Hipowers prolong the life of rail and of all joint parts.

Hipowers give an added safety factor to track.

Over 50 years of research and improvements—over 50 years of tests and trials—over 50 years of widespread use by leading railroads prove our spring washers to be one of the best railroad investments.

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J.

Spring Washers • Retaining Rings • Drop Forgings • Car Window Equipment • Railway and Bus Windows

ERICSON

The Logical Choice

because it's the

RAIL ANCHOR

with a

Take-Up

● **Efficiency unimpaired by numerous applications**

ERICSON Anchors maintain a positive vise-like grip on the rail base, and due to their large, ruggedly constructed tie bearing surface they readily withstand tremendous creepage strains imposed by modern heavy duty, high speed traffic—demanding better and MORE RAIL ANCHORS.

Ericson's time-proven design reduces maintenance costs. Reliable protection against creepage minimizes many consequent troublesome factors in track and roadbed upkeep.

Over twenty million Anchors with a Take-Up are in use by leading roads.

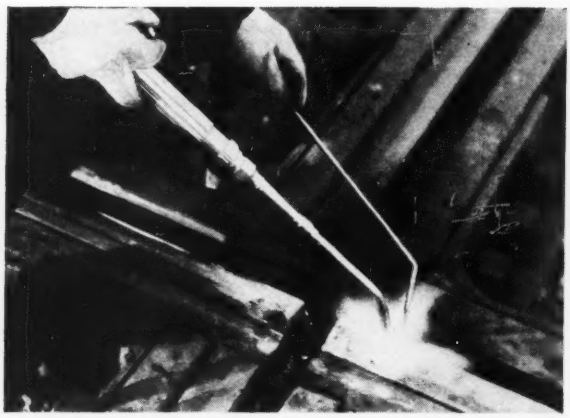
Manufactured and Sold by

ILLINOIS MALLEABLE IRON COMPANY

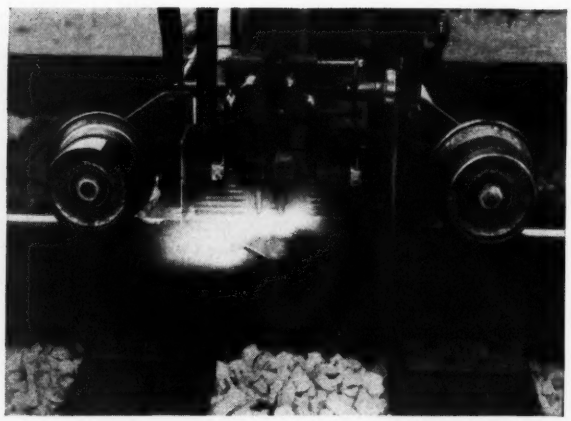
(RAILROAD DIVISION)

310 South Michigan Avenue **CHICAGO, ILLINOIS**

Oxweld reaches its — a Quarter Century



Under Oxweld procedures, worn crossings are restored to original surface before serious batter has occurred.



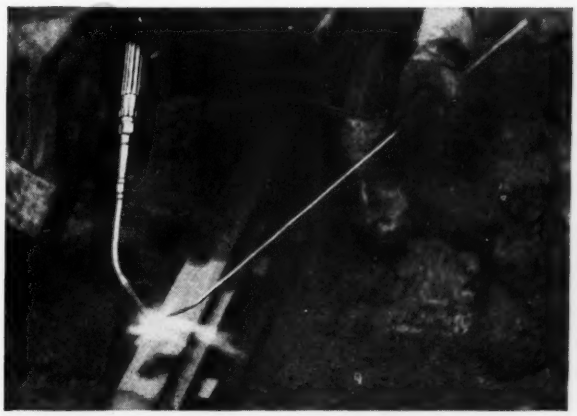
Hardening the ends of new rail by the Oxweld process retards batter and adds years of smooth, efficient life.

THE Oxweld Railroad Service Company is this year marking its silver anniversary—the completion of twenty-five years of continuous service in helping American railroads to take full advantage of the economies of oxy-acetylene welding, cutting and heat-treating.

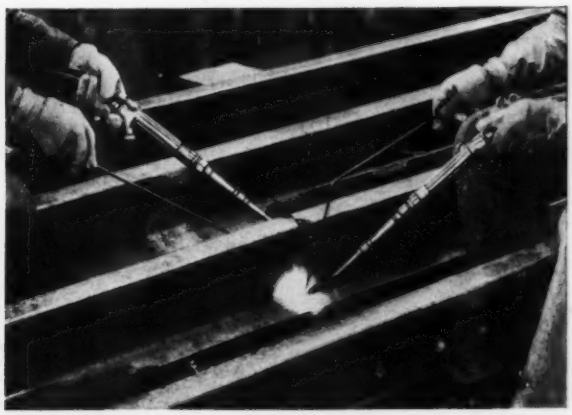
To contribute further to the profitable operation of maintenance-of-way departments, The Oxweld Railroad Service Company has developed and is constantly improving standard procedures for every oxy-acetylene requirement of track work. A few of these applications which reduce maintenance costs and speed up track work are shown in the accompanying illustrations.

The Oxweld Railroad Service Company co-ordinates for the railroads the manufacturing, research, engineering and service facilities of those Units of Union Carbide and Carbon Corporation which produce apparatus and

25TH Anniversary of Service to American Railroads



Building up rail ends by oxy-acetylene welding produces impact resistance and reduces the cost of joint maintenance.



Oxweld developments in butt-welding rail by the oxy-acetylene process afford desirable qualities in the finished joint.

supplies for oxy-acetylene welding and cutting. It thus supplies railroads not only with the materials required for this purpose but also with engineering assistance and supervisory and instruction service. Its field organization is thoroughly familiar with railroad problems. New methods and applications of the oxy-acetylene process are made available as they are developed, and uniformity of procedure for each specific job is assured.

This co-ordination of services has proved so economical to American railroading that now in the year of the Silver Anniversary of its founding The Oxweld Railroad Service Company is helping to maintain more than half the total mileage of track in the United States.

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

New York: Carbide and Carbon Building

UCC

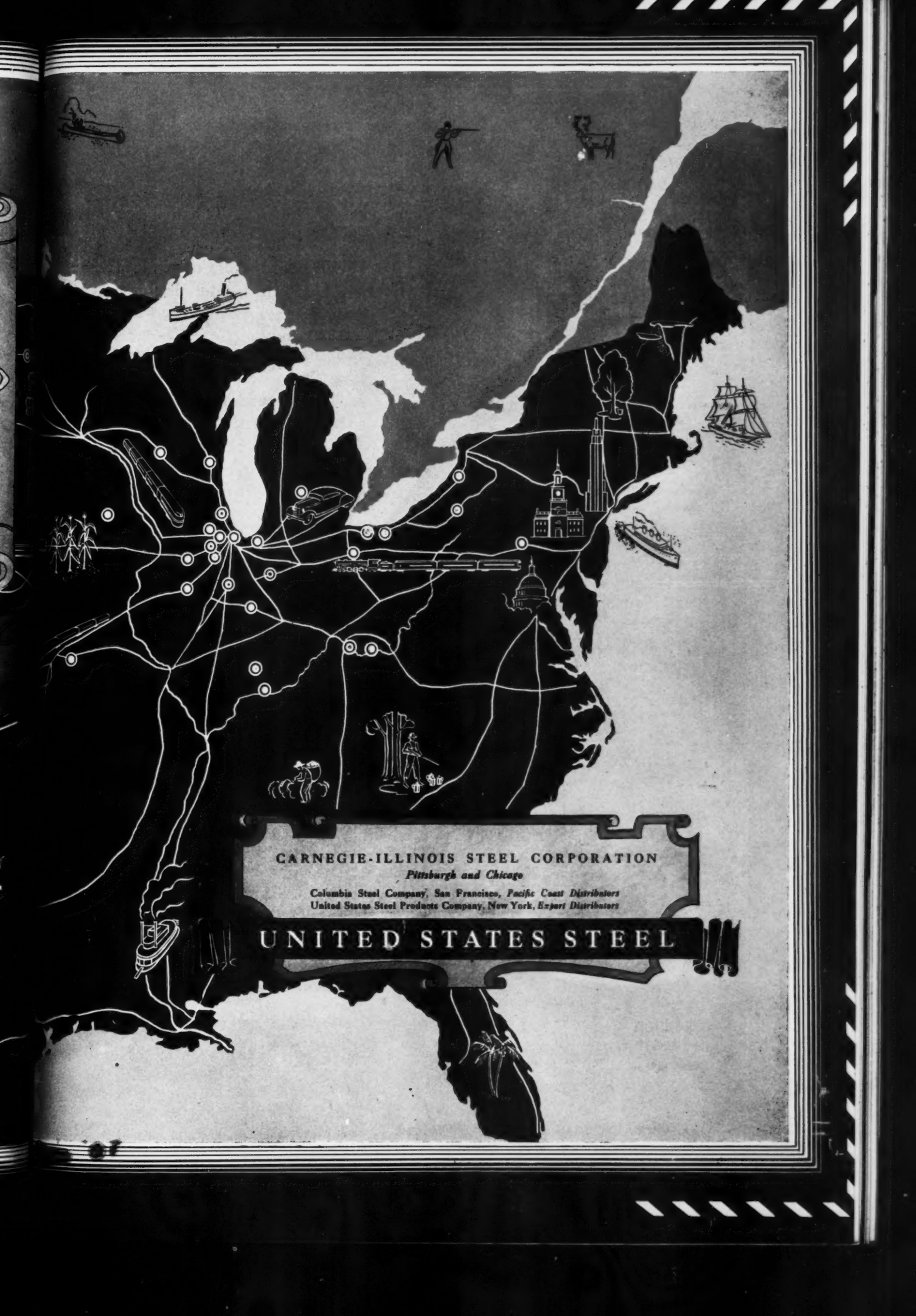
Chicago: Carbide and Carbon Building

OXWELD RAILROAD SERVICE

1912-1937

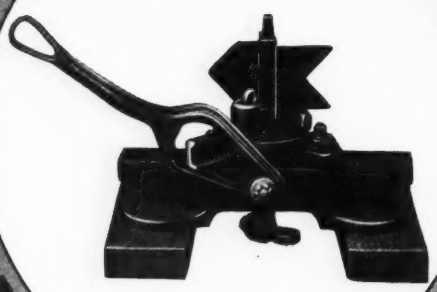
A QUARTER OF A CENTURY OF SERVICE TO THE MAJORITY OF CLASS I RAILROADS

At every Location
U·S·S Brunorized Rails are giving
Better Service
AS long ago as 1934, test sections of the new U·S·S Brunorized Rail were installed at 32 locations on 23 railroads — where temperatures vary from +113°F. to —47°F.; where track loads range from ceaseless pounding by heavy freight trains to sudden centrifugal shocks by speeding streamliners.
Without exception these service tests confirm laboratory studies. Both indicate that:
(1) Brunorizing virtually eliminates the danger of fissures and sudden fractures, even at record low temperatures.
(2) Controlled end-hardening reduces impact from battered rail ends, costly track repairs and will increase the average life of rails.
Every evidence, in fact, indicates that the U·S·S Brunorized Rail is the finest steel rail it is now possible to make in commerical production.
*Every star indicates a carefully studied test installation of U·S·S Brunorized Rails. In some cases a single star covers two near-by locations. A few test installations are located off main rail routes on heavily travelled secondary lines which could not be included on a map of this character.
U·S·S·BRUNORIZED RAILS
Brunorized and End-Hardened
N
W
E
S


CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
Columbia Steel Company, San Francisco, Pacific Coast Distributors
United States Steel Products Company, New York, Export Distributors
UNITED STATES STEEL

RACOR SPECIALTIES

RACOR AUTOMATIC SWITCH STAND



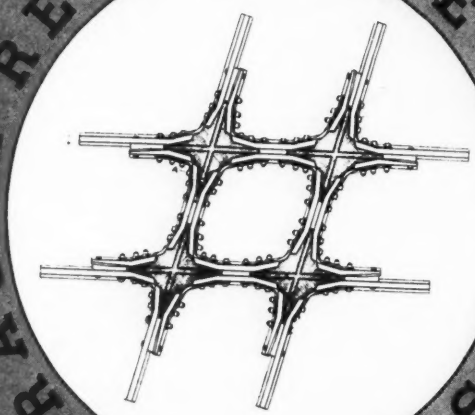
20-B

THE average life of an automatic stand is more than double that of a rigid stand.

The No. 20-B with its newly designed lever provided with an apron to protect its working parts from the entrance of dust and snow is safer and surer in operation. This protection adds still more to the life of the stand.

Automatic stands are replaced only when worn out. They are not broken or damaged by runaway cars.

RACOR REVERSIBLE INSERTS



RACOR

THESE crossings are economical because they last. The first cost compares favorably with other crossings designed for heavy traffic. The manganese inserts are reversible and interchangeable.

Racor crossings overcome troubles caused by too great rigidity and provide long-wearing manganese surfaces where greatest pounding and wear occur.

Worn castings can be reversed, which utilizes the entire surface of the insert before scrapping. Stock one corner casting for each crossing as a spare to be applied to any corner as needed.

RAMAPO AJAX CORPORATION

CANADIAN RAMAPO IRON WORKS, LIMITED

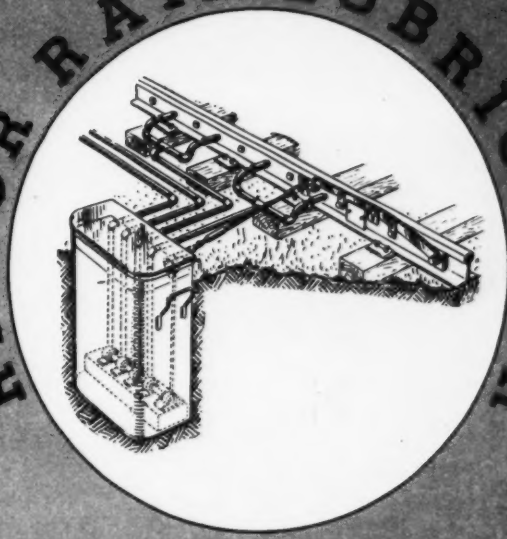
General Offices: 230 Park Avenue, N.Y.

RACOR WORKS: Hillburn, New York • Niagara Falls, N.Y. • Chicago, Ill.

East St. Louis, Ill. • Superior, Wis. • Pueblo, Col. • Los Angeles, Cal. • Seattle, Wash. • Niagara Falls, Ont.

ARE MONEY SAVERS

RACOR RAIL LUBRICATOR



THE entire circumference of the flanges of thirty-three inch wheels—are coated with an evenly distributed film of grease sufficient to protect curves for several miles. Substantial operating parts and flexible connections require but periodic inspection. It is only necessary to keep the reservoir filled and the few exposed parts oiled. Extensive tests over a long period prove that the money saved on rail and wheel purchases pays for the lubricator in a comparatively short time. It is a real investment.

RACOR

RACOR AUTOMATIC SWITCH STAND

17-B

AS IN other Racor Automatic Safety Switch stands, the 17-B provides positive hand throw, a resilient connection to switch points so that no parts can be overstressed and fail through fatigue, and the well tried automatic mechanism which provides protection against broken switch points, damaged stands and derailed cars.

The improved design with less moving parts prevents accumulation of lost motion and insures proper alignment of target and lamp for years.

RAMAPO AJAX CORPORATION

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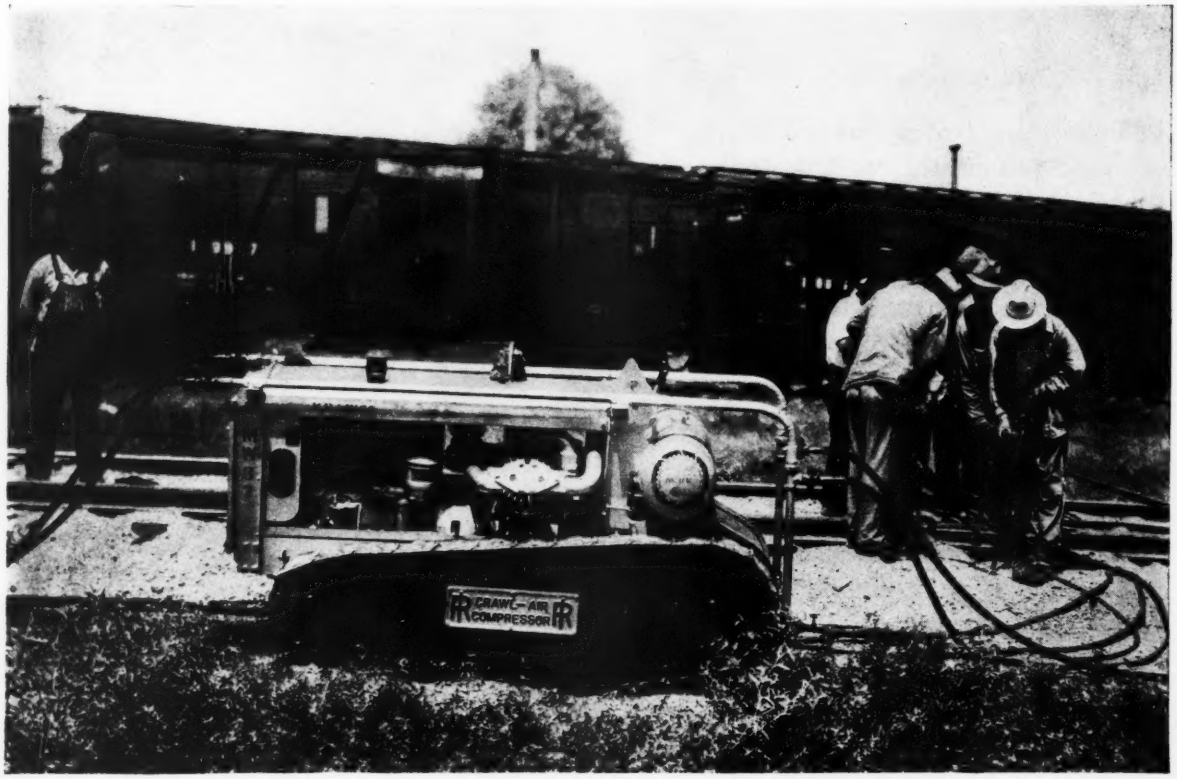
East St. Louis, Ill. . Superior, Wis. . Pueblo, Col. . Los Angeles, Cal. . Seattle, Wash. . Niagara Falls, Ont.

FOR THE MOST EFFICIENT ANTI-FRICTION PERFORMANCE IN COMPRESSORS



Ingersoll-Rand Crawl-Air Type 2-stage Air-Cooled Portable Compressor equipped with TIMKEN Bearings engaged in railway track maintenance work.

Tapered Roller
TIMKEN BEARING
EQUIPPED

A symbol of quality for any piece of equipment with which it is associated

8 Budd-built Zephyrs are now rolling on TIMKEN Bearings.

Glide — as you ride a Timken-equipped Train

When you buy a compressor equipped with TIMKEN Tapered Roller Bearings you are assured of full anti-friction efficiency, for in addition to eliminating friction, TIMKEN Bearings provide everything else dependable compressor service calls for, including radial-thrust load capacity and ability to hold moving parts in correct and constant alignment.

Timken-equipped compressors are economical of power, present no difficult lubrication problems and are notable for low maintenance cost.

Specify Timken-equipped when buying anti-frictionized compressors of any type.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; Timken Rock Bits; and Timken Fuel Injection Equipment.

TIMKEN

TAPERED ROLLER BEARINGS

Think of this NORDBERG LINE *when planning the budget for next year's maintenance program . . .*

With next year's budget soon coming up for consideration, two questions naturally arise. How can a better quality of track work be secured? How can more maintenance work be accomplished at a lower expenditure?

This Nordberg Line of Maintenance Tools answers these two questions. For rail laying and maintaining or reconditioning rail in service, there is a Nordberg Tool exactly suited to the job. It will do it better and at less expense.

For further information on the Nordberg Line, and how these tools can be used for your next year's program, visit Booths 68, 69 and 70 at the Roadmasters' Show.

NORDBERG MFG. CO.
MILWAUKEE

1. Adzing Machine
2. Spike Puller
3. Power Jack
4. Surface Grinder
5. Utility Grinder
6. Precision Grinder
7. Track Wrench
8. Rail Drill
9. Track Shifter

Drainage Maintenance

Cletrac off-track equipment at work . . . spreading the dirt in the most economical way possible . . . with a bulldozer at a cost of less than 8 cents a yard.

The job in progress. Notice the bank along the right-of-way in the background . . . how it is being spread out in the foreground.

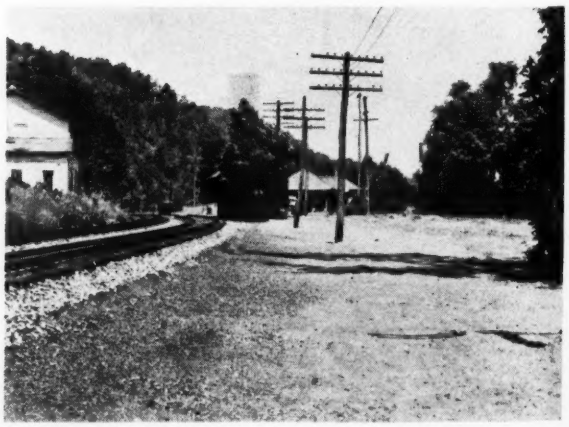
at a fraction of former cost

At a cost of less than 8 cents a yard, this Eastern railroad is cutting down the banks along its right-of-way and providing a better drainage slope. As usual with Cletracs, the work is being done without interference to trains.

The advantages are many: a more solid road bed . . . less underground moisture under the tracks . . . reduced trouble from snow . . . less subsequent maintenance of the drainage system . . . a more attractive right-of-way.

There's a Cletrac Crawler for every job from 22 to 94 horsepower, either gasoline or Diesel powered. We'll be glad to supply details.

The Cleveland Tractor Company
CLEVELAND, OHIO



Here's the finished job . . . a gentle drainage slope . . . no erosion . . . easy subsequent maintenance with Cletrac off-track equipment . . . a more attractive right of way.

CLETRAC CRAWLER TRACTORS

The only tractors with controlled differential steering that keeps both tracks pulling at all times . . . on the turn as well as on the straightaway.

REDUCE TRACK

by the AIRCOWELDING PROCESS

THE cumulative effect of battered rail ends is clearly reflected in track maintenance costs. Excessive wear in bolts and angle bars, loose joints, shattered ties and dislodged ballast are some results of rail batter that materially increase the cost of track up-keep.

The AIRCO way* provides a proven welding process for rail end reclamation and heat treating. Many roads have service-tested the AIRCO way and now accept it as *standard practice.* The low *first* cost of welding equipment and the extreme portability and flexibility of this process lead directly to large annual savings.

Our engineers would be glad to discuss rail reclamation problems with you and furnish complete cost data.

*The AIRCO way—Airco Oxygen and Acetylene, Airco Apparatus and Engineering Assistance.

AIR REDUCTION
SALES COMPANY

General Offices: 60 East 42nd Street, New York, N. Y.
DISTRICT OFFICES in PRINCIPAL CITIES

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE

MORRISON

Leads the Way In Reducing Railway Maintenance Costs!

Services and Supplies For Railroads — MORRISON RAILWAY SUPPLY CORP. — **Devoted to Maintenance Economies**

Fourteen years ago Morrison Railway Supply Corporation began serving the railroads. Our most valuable assets today are the knowledge that we have gained during this long period of service . . . the vast files of reliable and valuable data that tell the story of the railroads needs and requirements . . . and the ability of our trained and experienced personnel to apply this knowledge to your problems of today.

MORRISON METALWELD PROCESS, Inc. *Welding Engineers & Contractors*

Morrison welding units have established a reputation for quality, accuracy and dispatch. These units are available on short notice for all types of maintenance of way welding. Inspection and consultation services are yours without cost or obligation.

Bridge Reinforcing and Repairing

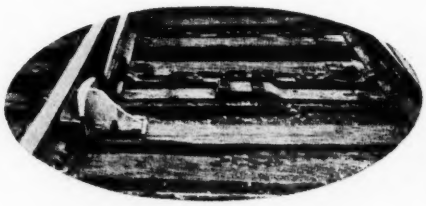
•

Reconditioning Frogs and Crossings

•

Building Up Rail Ends

★ *Portable Equipment On The Job Anywhere*
★ *Work Performed In Track, Under Traffic*



The Improved "TREGO" SWITCH POINT GUARD

An economical, long-lasting guard with important safety features not to be found in any other appliance. TREGO can be applied without replacing worn switch point. Installation cost is the ONLY cost. Repeat orders from Class I Railroads are proof of its superior qualities.

The OSMOSE *Wood Preserving* PROCESS

Proved and Accepted By Public Utilities for Economy In Maintenance

EXCLUSIVE RAILROAD DISTRIBUTORS

The simple, economical and effective Osmose Process is the most talked of preservative treatment of the day. Find out how this remarkable treatment can add years of service life to your untreated standing poles, piling, trestles, bridges and other wood structures. Write for informative booklets.

MORRISON RAILWAY SUPPLY CORP.

MORRISON BLDG., BUFFALO, N.Y. — **20 W. JACKSON BLVD., CHICAGO**

NEW YORK — ST. LOUIS — WASHINGTON

STOP THIEF!

A systematic program of subdrainage with Armco Perforated Pipe will reduce your operating costs — speed up your schedules — and increase your ability to gain and hold new business.

SOUND JUDGMENT will not allow progressive railways to go on paying *thousands of dollars every year* for slow orders and excessive track maintenance. Today these costly conditions can and are being permanently eliminated by scientific subdrainage methods.

In hundreds of cases where Armco perforated pipe has been installed, slow orders have been removed, safety and passenger comfort improved, and maintenance costs greatly reduced. Call in an experienced Armco drainage engineer and let him show you the actual savings accomplished by typical installations. Ask him to work with your own staff in achieving similar results for you.

This highly specialized service is offered to you without obligation. Simply address our nearest office. Ingot Iron Railway Products Company (Member of the Armco Culvert Mfrs. Assn.), Curtis Street, Middletown, Ohio; Berkeley, California; Philadelphia, Dallas, Atlanta, Salt Lake City, Minneapolis, Los Angeles, St. Louis, Portland, Cleveland, Spokane, Chicago, Richmond, Houston and Denver.

ARMCO ARMCO **PERFORATED PIPE**

RAIL LAYING FINISHED on TIME

I-R AIR OPERATED TOOLS

Give That EXTRA SPEED and Your RAIL LAYING Program is Done BETTER—EASIER and is Finished per schedule

INGERSOLL-RAND Pneumatic Tools do the job quickly. Each tool is the result of many years' experience in making the right tool for its particular job. Consequently, in addition to speed, a far better and more permanent job is obtained—thereby lowering costs.

The I-R Spike Drivers draw ties up tighter to the rail and require but 3½ seconds from set up position. Other outstanding tools include the speedy spike puller, powerful wrenches for bolting and unbolting, wood borers, rail drills, screw spike drivers—all sturdy track tools effecting substantial savings in time for you.

The INGERSOLL-RAND MT-3 Pneumatic Tie Tamper is economical because of its low air consumption and yet is the most powerful and durable tamper made. Its hard uniform blows produce a sound pocket-less roadbed which stands the gaff longer under heavy high speed traffic.

Greatest economies are obtained when these competent tools are used in conjunction with the I-R two stage air-cooled compressor. Let us send you booklet showing performance data on I-R labor-aiding tools.

Atlanta, Birmingham, Boston, Buffalo, Butte, Chicago, Cleveland, Dallas, Denver, Detroit, Duluth, El Paso, Hartford, Houston, Kansas City

Ingersoll-Rand

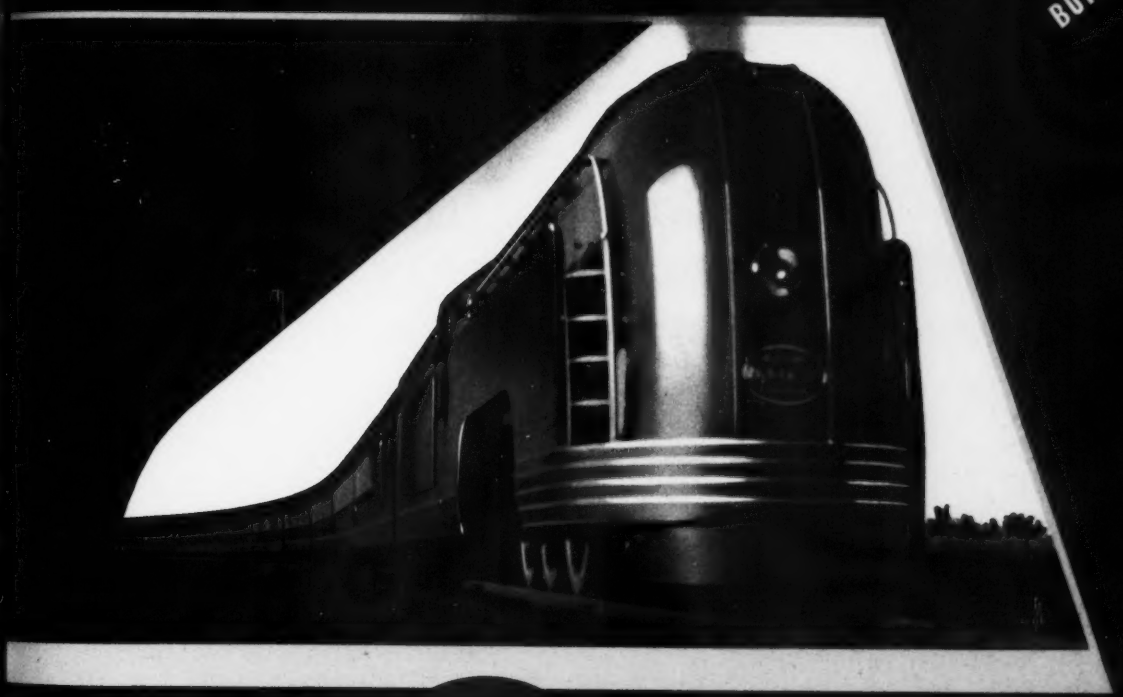
11 BROADWAY, NEW YORK, N. Y.

549

Knoxville, Los Angeles, Newark, New York, Philadelphia, Picher, Pittsburgh, Pottsville, Salt Lake City, San Francisco, Scranton, Seattle, St. Louis, Tulsa, Washington

KOPPERS

MANUFACTURERS
DISTRIBUTORS
OPERATORS
DESIGNERS
PRODUCERS
BUILDERS



Koppers Divisions, Subsidiaries and Affiliates Serving the Railroad Field

THE WOOD PRESERVING CORPORATION	PITTSBURGH, PA.
NATIONAL LUMBER & CREOSOTING COMPANY	TEXARKANA, ARK.
TAR AND CHEMICAL DIVISION	PITTSBURGH, PA.
THE KOPPERS COAL COMPANY	PITTSBURGH, PA.
NEW ENGLAND COAL & COKE COMPANY	BOSTON, MASS.
BARTLETT HAYWARD DIVISION	BALTIMORE, MD.
AMERICAN HAMMERED PISTON RING DIVISION	BALTIMORE, MD.
WESTERN GAS DIVISION	FORT WAYNE, INDIANA
THE WHITE TAR COMPANY OF NEW JERSEY, INC.	KEARNY, N. J.
THE MARYLAND DRYDOCK COMPANY	BALTIMORE, MD.
GAS AND COKE DIVISION	PITTSBURGH, PA.

COMPOSITE TIMBER-CONCRETE BEAM CONSTRUCTION AIDS GRADE CROSSING ELIMINATION PROGRAMS

Grade crossing elimination appropriations go further, through the use of the new Composite Beam type of bridge construction. Permitting the use of a size and grade of lumber easily obtainable, and low in cost as compared to usual requirements, the Composite Timber-Concrete Beam type of construction effects real savings. One-third of the creosoted planks used are full-span length. Through the use of shear-developers, the Composite Beam develops properties equivalent to a timber beam of equal dimensions. No forms are needed for pouring the concrete deck. The wood construction has ample strength to support loads placed on it during concreting. Maintenance is exceptionally low.

THE WOOD PRESERVING CORPORATION

AYER AND LORD DIVISION
CHICAGO, ILL.

PITTSBURGH, PA.

CENTURY DIVISION
PITTSBURGH, PA.

NATIONAL LUMBER AND CREOSOTING CO.
TEXARKANA, ARK.

CAROLINA WOOD PRESERVING CO.
CHARLESTON, S. C.

KOPPERS

PRESSURE-TREATED TIMBER RESISTS WEAR AS WELL AS DECAY— The assumption that untreated platform planking will "wear out before it rots out" does not take into account the accelerated wear that first stages of rot can bring. Pictured is a freight loading platform with a 2-inch Southern Pine deck, pressure-treated with salt preservative. It was installed in 1935. Over 9500 freight car loads of merchandise have been handled across this platform on steel-wheeled trucks, with practically no signs of deterioration. Twelve months was the average life of untreated material previously used. Many railroads also use pressure-treated timber for passenger platform planking, as well as posts and supports.

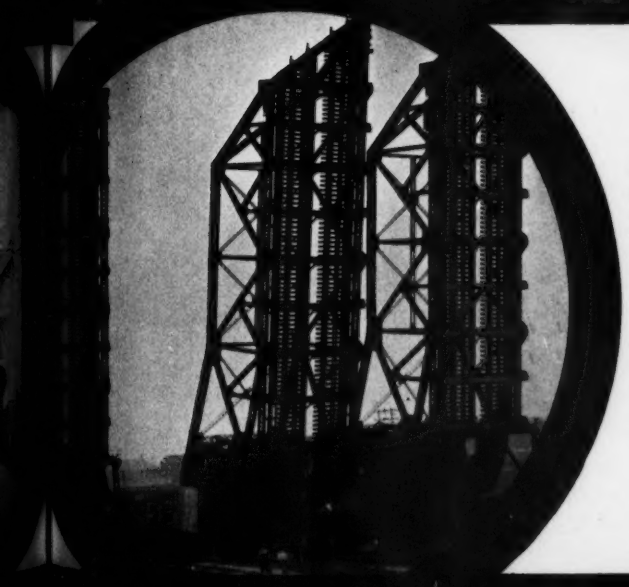
TO SAVE TIMBER

RIVER-RAIL TERMINALS USE LARGE QUANTITIES OF CREOSOTED WOOD—This $450,000 river-rail coal transfer has a breastwork 400 feet long, with 24 mooring pile clusters at either end for barge fleets. Wood is pressure-treated to protect both the timber and the investment.

CREOSOTED TIMBERS ADD TO LIFE EXPECTANCY OF TANK AND SUPPORTS—Wood is more economical *if it lasts* . . . and lasting qualities are assured for this tank. Both staves and supports are pressure-treated with creosote.

LOW COST CULVERTS WITH HIGH STRENGTH FROM CREOSOTED TIMBERS—A departure from the conventional type of culvert, this framed timber type offers maximum strength and service at minimum cost, through the use of creosoted wood.

MANY CRIBBING AND RETAINING WALLS ARE BUILT OF PRESSURE-TREATED TIMBERS—Creosoted timbers offer a type of construction that is low in initial cost, and require a minimum of maintenance expense. They withstand severe climatic conditions—heat, cold, moisture, etc. They may be salvaged for use again and again.



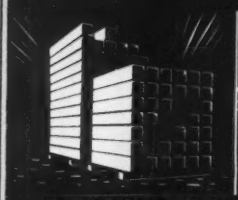
THESE LIFT BRIDGES ARE PROTECTED WITH CREOSOTED TIES AND TIMBERS—The combination of heavy loads and difficulty of replacement required the use of enduring ties and timbers in this lift-bridge application. Creosoted wood, pressure-treated, was used.

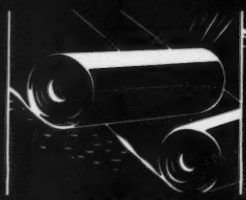
CHECK LIST OF KOPPERS *Products*

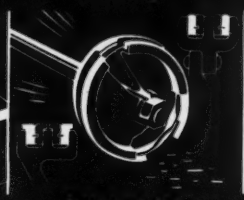
FOR THE RAILROAD FIELD

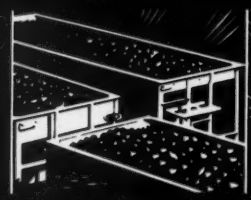
	TREATED TIMBER, TIES, POSTS, ETC.	ROOFING MATERIALS	PISTON RINGS	COAL	WATER-PROOFING MATERIALS	BITUMINOUS PAINTS	TARMAC ROAD MATERIALS	FAST'S COUPLINGS	CREOSOTE	CYLINDER PACKING	WEED KILLERS	INSECTI-CIDES AND DISINFEC-TANTS	PLATE WORK	CAR FERRIES, RAILROAD BARGES, ETC.
ROADBEDS	A								D		F			
LOCOMOTIVES			C	B		D				C				
STATIONS	A	D		B	D	D			D			F		
SHOPS	A	D	C	B	D	D		E	D			F	E&G	
BRIDGES	A				D	D	D		D				E&G	
TUNNELS	A				D	D	D						E&G	
DRIVEWAYS	A				D		D				F			
POWER HOUSES	A	D	C	B	D	D		E	D	C			E&G	
STRUCTURAL	A	D			D	D			D				E&G	
GRADE CROSSINGS	A						D							
CATTLE PENS	A	D			D	D			D			F		
RAILROAD MARINE OPERATIONS	A	D	C	B	D	D			D	C		F	E&G	

A—The Wood Preserving Corporation, Pittsburgh, Pa. B—The Koppers Coal Company, Pittsburgh, Pa. C—American Hammered Piston Ring Division, Baltimore, Md. D—Tar and Chemical Division, Pittsburgh, Pa. E—Bartlett Hayward Division, Baltimore, Md. F—The White Tar Company of New Jersey, Inc., Kearny, N. J. G—Western Gas Division, Fort Wayne, Ind. H—The Maryland Drydock Company, Baltimore, Md.


Treated Ties and Timbers

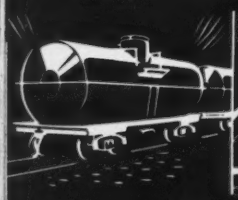

Roofing and Waterproofing


Cylinder Valve Packing

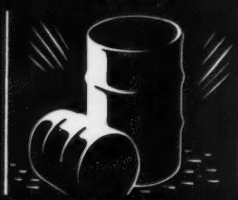

Coal

Bituminous Paints

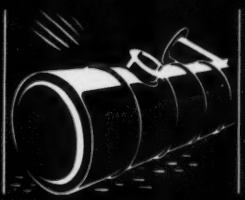
Tarmac


Creosote

Piston Rings


Weed Killer

Insecticides and Disinfectants


Platework

Barges and Ferries

KOPPERS COMPANY

After a winter of use, this concrete-slab-supported track continues in excellent condition. Slabs remain lined up as true as the day they were placed.

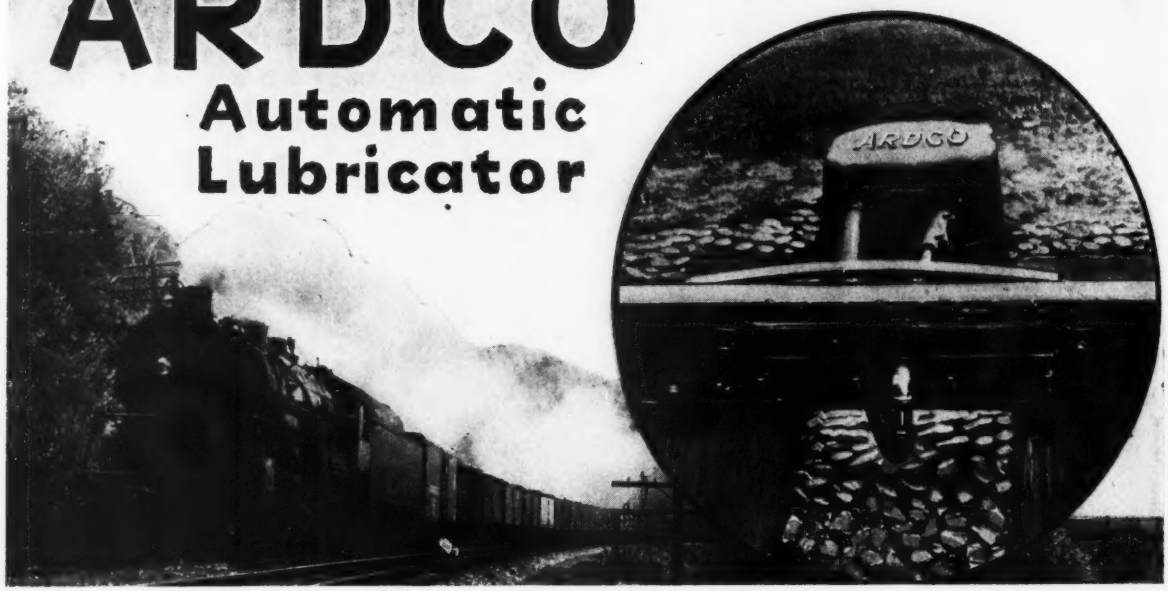
Minor changes in track design cannot alone solve the problem of producing a smoother ride and, at the same time, reduce the cost of track and roadbed maintenance. What is needed is a rigid track foundation that absorbs and spreads the load over a wider area of subgrade; that provides a comfortable ride by building a track that is *smooth when loaded.*

For this reason, interest is growing in the possibilities of concrete-supported track. Various types of installations of such track in terminals, tunnels and out on the line, have given excellent service for as high as 20 years.

Roadbeds properly designed with concrete absorb and distribute loads over wider areas . . . reduce "track wave" set up by the progressive motion of load points . . . eliminate the pumping action of poorly-supported ties . . . simplify drainage . . . resist frost damage . . . provide uniform rail support at all seasons and over all soils. The results are: a smoother, more comfortable ride for passengers; a marked reduction in maintenance costs; longer life for rails and rolling stock.

PORTLAND CEMENT ASSOCIATION
Dept. 10-27, 33 West Grand Avenue, Chicago, Illinois
A National Organization to Improve and Extend the Uses of Concrete

ARDCO
Automatic Lubricator



Dependable—Efficient and Economical . . . . .

SUMMER AND WINTER—in blistering hot weather or zero temperatures when the right of way is covered with ice and snow you will always find an ARDCO Automatic Rail Lubricator working.

And you will find ample evidence of efficiency—grease right on the throat of the rail where you need it—way around to the end of the curves you want lubricated.

You do not have to worry about ARDCO Automatic Lubricators wasting grease or requiring periodical attention. Performance of hundreds of installations prove that they are exceptionally economical to operate and maintain.

The dependability, efficiency and economy of ARDCO Automatic Lubricators insure maximum returns from rail lubrication.

We also manufacture the
Sesmo Automatic Rail Lubricator

ARDCO MANUFACTURING CO.

1 NEWARK ST. HOBOKEN, N. J.

DUFF-NORTON

the Standard Track Jack Specification for Over 50 years!

Over 50 years of progressive development in jack design and construction make Duff-Norton today, as always, the best buy in jacks—bar none!

Time-tried and time-proved in the hardest railroad service through two generations of railroad men, Duff-Norton Genuine Barrett Track Jacks are backed by an unequalled service record for efficiency, rugged durability and safety under all conditions of service.

Send for your copy of our new Catalog describing the complete line of Duff-Norton Lifting Jacks—the most complete and comprehensive publication of its kind ever published!

THE DUFF-NORTON MANUFACTURING CO.
PITTSBURGH, PA.

"THE HOUSE THAT JACKS BUILT"

2 More Roads

Great Northern & Denver & Salt Lake
INSTALL CONTINUOUS THERMIT WELDED *Rails*

Thermit Rail Welding is making rapid progress. The trend to continuous rails is growing by leaps and bounds. Important railroads are fast becoming convinced both of the savings to be gained through the elimination of rail joints and of the feasibility of welding rails into long, jointless stretches.

Now two more roads join the roster of pioneers in Thermit Welded track; the Great Northern, with 5700 ft. of jointless track at Rexford, Montana; the Denver & Salt Lake, with more than six miles of welded track in its Moffat Tunnel, 10,000 ft. up in the mountains of Colorado. In addition, the Delaware & Hudson, continuing the work started four years ago, is putting in more Thermit welded track in upper New York State.

With the Bessemer & Lake Erie, the Northern Pacific, the Erie, the Chicago, Milwaukee & St. Paul, and the New York Rapid Transit Corporation, this brings the total number of roads who have installed long, Thermit welded rails up to eight.

These installations are pointing the way, through eliminated joint maintenance and reduced track upkeep in general, to potential savings for American railroads that have been estimated as high as $136,000,000 a year. It will pay you to investigate fully. Write for data.

THERMIT
Rail
WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO

REDUCES MAINTENANCE EXPENSES

Exhibit Roadmasters' Convention Booth 116.

Prolongs Life of Ties and Rail

THE Lundie Tie Plate with its rounded steps of resistance holds track to gauge, and, most important of all, accomplishes this without injuring a single fibre of the tie. This scientifically designed plate provides tremendous holding power against plate movement and consequent spreading of track. The plate seats itself perfectly and gives proper inclination to rail so that wheels track properly . . . Lundie Plates are made with single or double shoulders to comply with A.R.E.A. specifications, or can be supplied to meet your own specifications. In preparing your 1938 budget, be sure to specify Lundie Tie Plates. They assure maximum return from investment in ties and rail.

THE LUNDIE ENGINEERING CORPORATION

19 West 50th St., New York 59 E. Van Buren St., Chicago

LUNDIE TIE PLATE

Companies whose advertisements have appeared in

Railway Engineering and Maintenance

during the last year

*Air Reduction Sales Company
*American Fork & Hoe Company, The
American Hammered Piston Ring Division, Koppers Co.
American Manganese Steel Company
*American Steel & Wire Company
*Ardco Manufacturing Co.
*Barco Manufacturing Company
*Bethlehem Steel Company
*Carnegie-Illinois Steel Corporation
*Cleveland Tractor Company, The
*Columbia Steel Company
*Dearborn Chemical Company
Detroit Harvester Company
*Duff-Norton Manufacturing Company, The
du Pont de Nemours & Co., Inc., E. I.
*Eaton Manufacturing Company
*Elastic Rail Spike Company
*Fairbanks, Morse & Co.
*Fairmont Railway Motors, Inc.
Flexrock Company
*General Electric
Grip Nut Company
*Hayes Track Appliance Co.
*Illinois Malleable Iron Company
*Ingot Iron Railway Products Company
*Industrial Brownhoist Corp.
*Ingersoll-Rand
Johns-Manville
*Jordan Co., O. F.
*Koppers Company
Layne & Bowler, Inc.
*Lehon Company, The
Lowell Wrench Co.
*Lufkin Rule Co., The
*Lundie Engineering Corporation, The
*Maintenance Equipment Co.
*Mall Tool Company
*Master Builders Co., The
*Metal & Thermit Corporation
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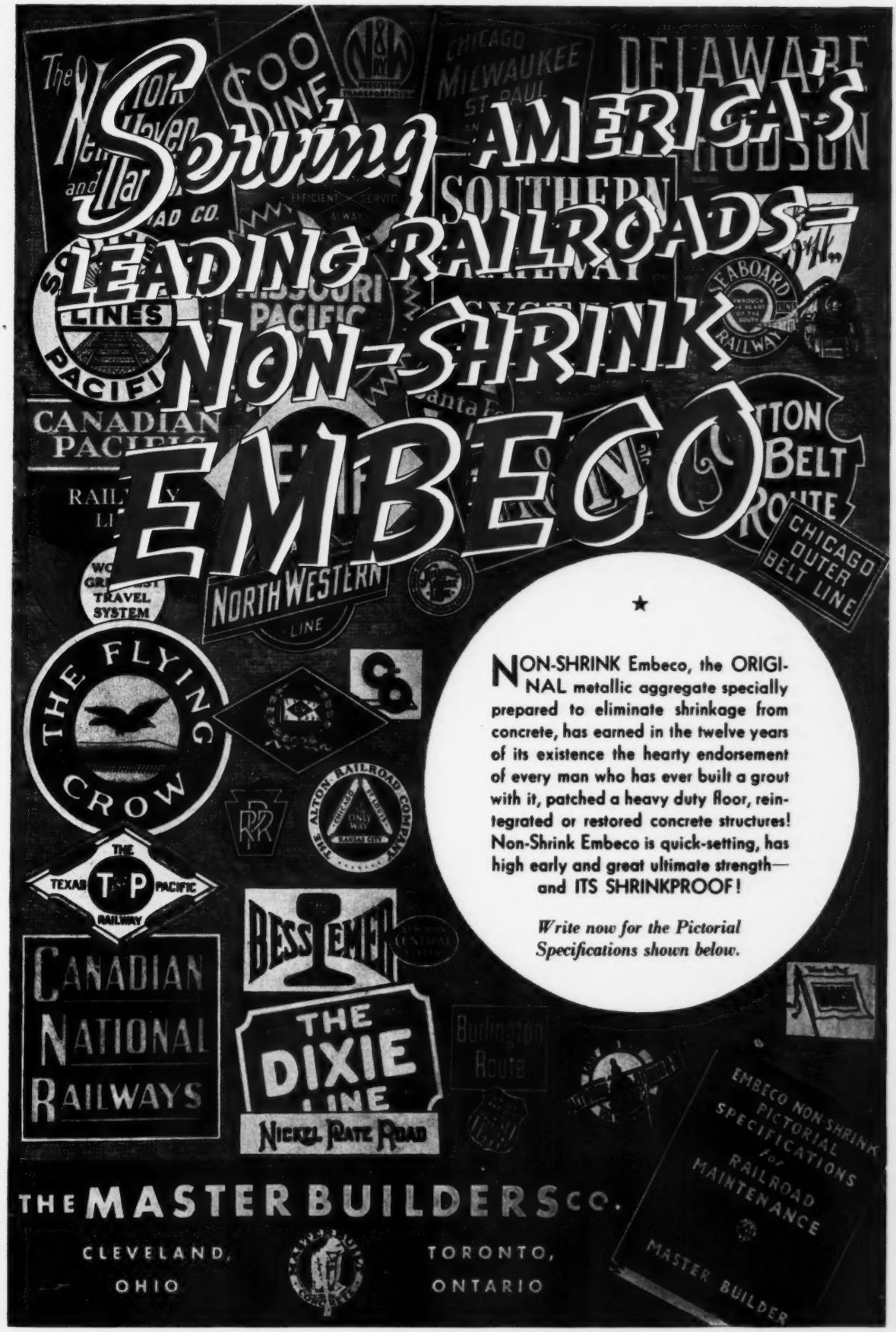
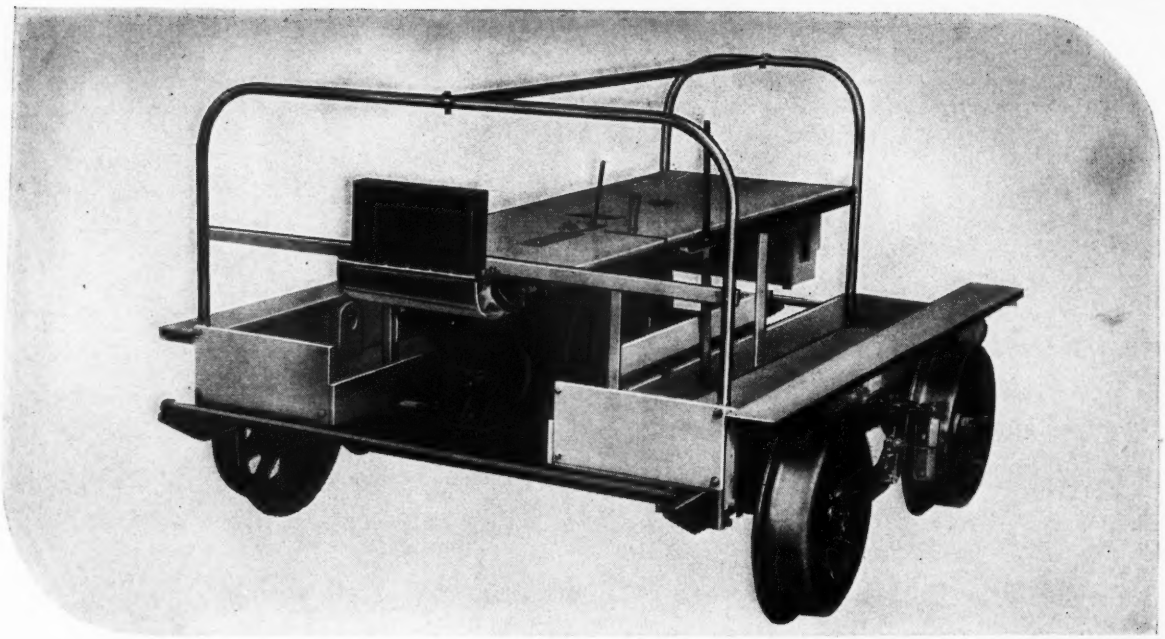
*Morrison Metalweld Process, Inc.
*Morrison Railway Supply Corp.
*National Carbide Corporation
*National Lead Company
*National Lock Washer Company, The
National Railway Appliances Association
*Nordberg Mfg. Co.
*Ohio Electric Manufacturing Co., The
*Oxweld Railroad Service Company, The
*P. & M. Co., The
*Peerless Mfg. Corp.
Permutit Company
*Pettibone Mulliken Co.
*Porter, Inc., H. K.
*Portland Cement Association
*Q & C Company, The
*Rail Joint Company, Inc., The
*Railroad Accessories Corporation
*Rails Company, The
*Railway Maintenance Corporation
*Railway Track-work Co.
*Ramapo Ajax Corporation
Rawls Company, S. E.
Ross and White Company
*Russell Snow Plow Company
Sika, Inc.
*Stonhard Company
*Stulz-Sickles Co.
Tar & Chemical Division, Koppers Co.
Taylor-Wharton Iron and Steel Company
Teleweld, Inc.
*Templeton, Kenly & Co.
*Tennessee Coal, Iron & Railroad Company
*Timken Roller Bearing Company, The
Toncan Culvert Manufacturers Association
*Track Specialties Co.
*Truscon Steel Company
*United States Steel Corporation
*Warren Tool Corporation
*Williams & Co., J. H.
Wood Preserving Corporation, The
*Woodings Forge & Tool Co.
Woodings-Verona Tool Works

*In this issue.


Serving AMERICA'S LEADING RAILROADS
NON-SHRINK
EMBECO
NON-SHRINK Embeco, the ORIGINAL metallic aggregate specially prepared to eliminate shrinkage from concrete, has earned in the twelve years of its existence the hearty endorsement of every man who has ever built a grout with it, patched a heavy duty floor, reintegrated or restored concrete structures! Non-Shrink Embeco is quick-setting, has high early and great ultimate strength—and ITS SHRINKPROOF!
Write now for the Pictorial Specifications shown below.
THE MASTER BUILDERS CO.
CLEVELAND, OHIO
TORONTO, ONTARIO
EMBECO NON-SHRINK PICTORIAL SPECIFICATIONS for RAILROAD MAINTENANCE
MASTER BUILDER



THE SHEFFIELD 49 BW MOTOR CAR

SPEEDY . . . ROOMY . . . LIGHT . . .

● The closest thing to a *car of all work* is the Sheffield 49 BW.

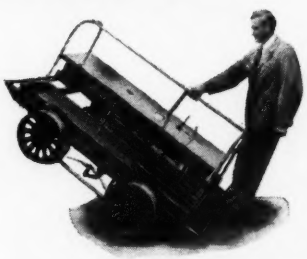
It is roomy enough for a gang of six to eight men and their normal kit of tools, yet light enough for a track inspector to take out alone with safety.

The powerful water-cooled, condenser type engine gives it plenty of speed even with heavy loads . . . 32 miles per hour with a full load of men and tools; 15 with an additional 2-ton payload on a trailer, and with the standard front windshield on motor.

Every detail of design and construction has grown out of long experience. Sheffield cars were first on the rails and are still first.

It is a car your men will like, a car that will cut costs, that will speed maintenance and construction work for you.

Get the complete facts by writing Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.



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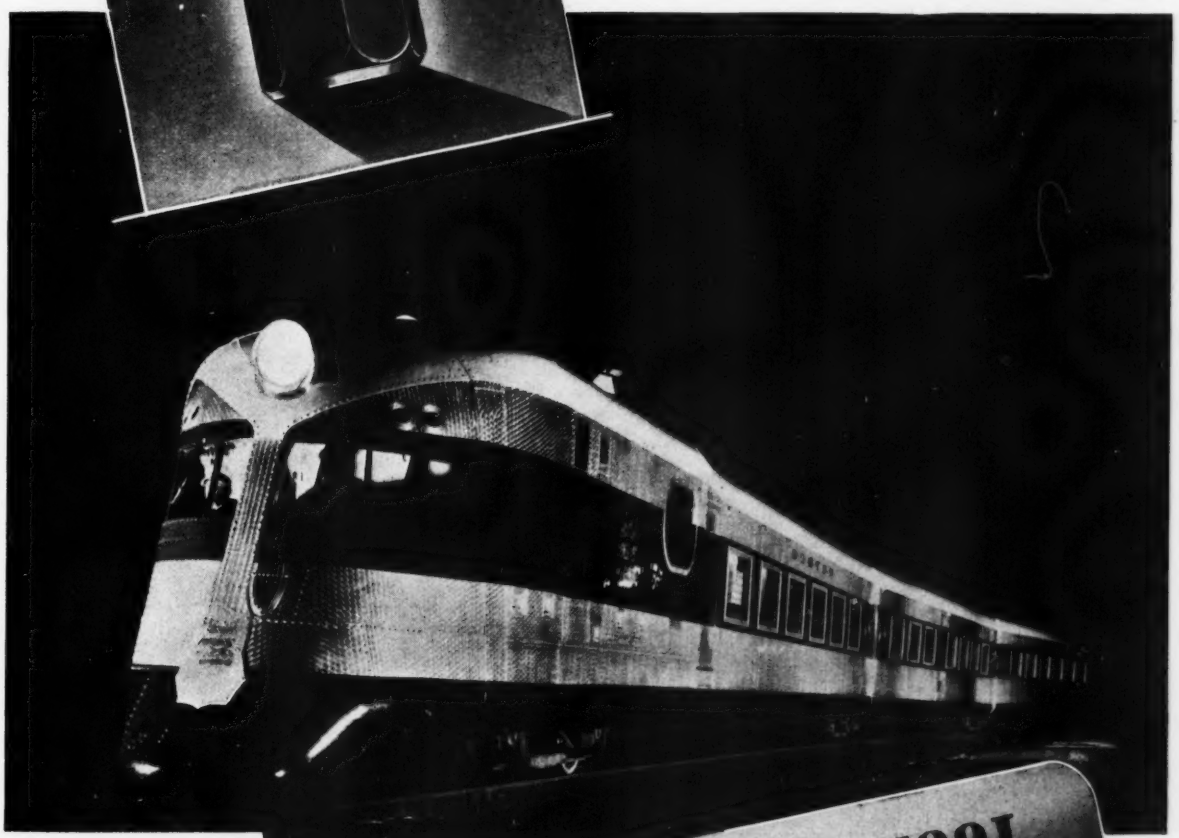
FAIRBANKS MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
FAIRBANKS SCALES
RAILROAD EQUIPMENT
WATER SYSTEMS
REFRIGERATORS
RADIOS
WASHERS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS

Railway Equipment

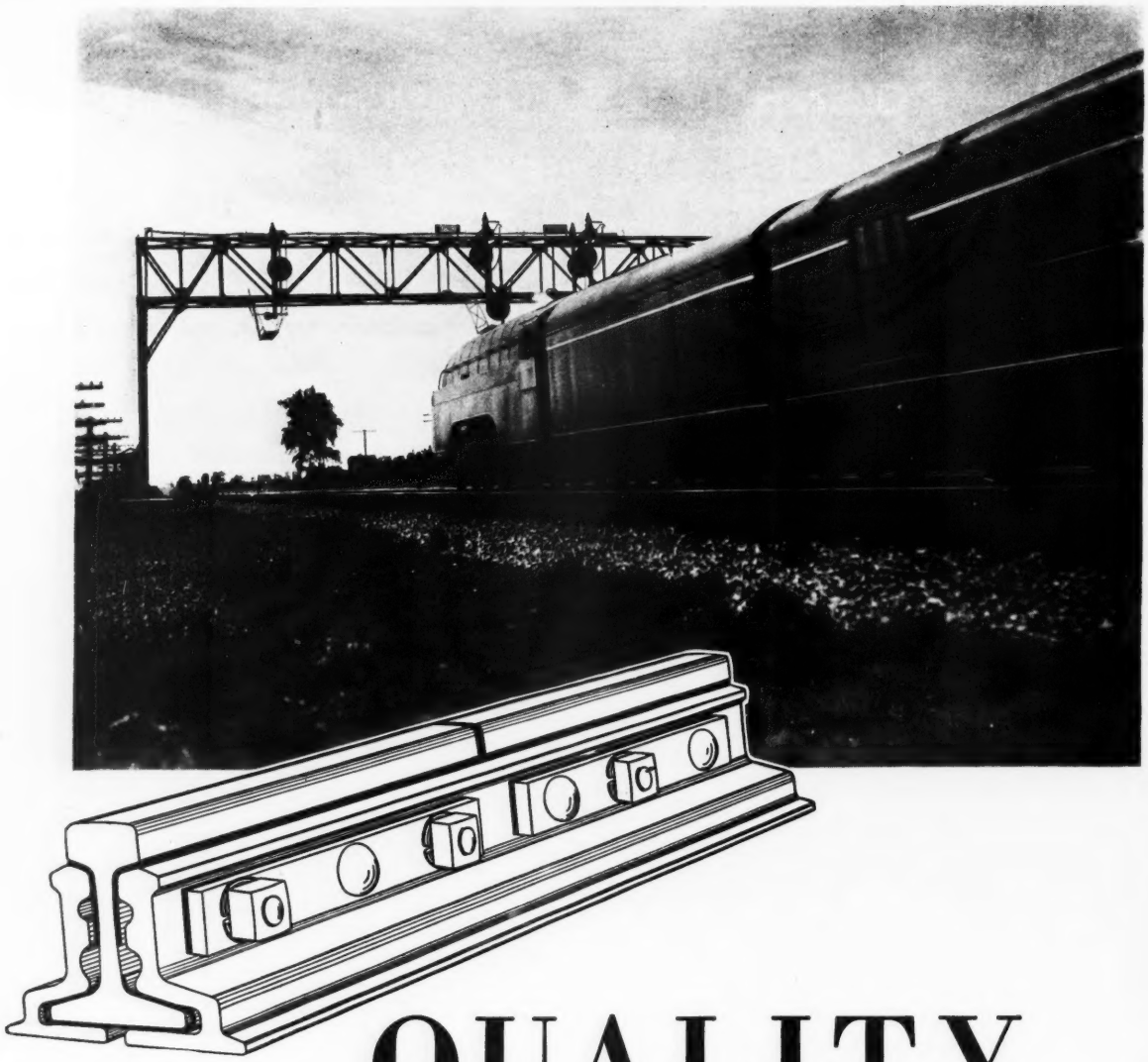
TOOLS THAT ARE SAFE FOR SAFE ROADBEDS

The ordinary hand tools are all you need in your tool drawer at home. But . . when you are meeting the extra heavy demands of road gangs who put tools to long hard service, you need the extra tough, safe, and long life tools. The Devil Tools are made of controlled steel, forged and heat treated by skilled craftsmen, and are constructed especially for railroad gangs.



This catalog is ready for you. It shows all types, sizes, and weights of Devil Tools.

WARREN TOOL CORPORATION
WARREN, OHIO



QUALITY COUNTS

THE RAIL JOINT COMPANY INC.,

50 CHURCH STREET NEW YORK, N. Y.

MAKE CURVES LIKE TANGENTS
In Safety—In Maintenance Economy

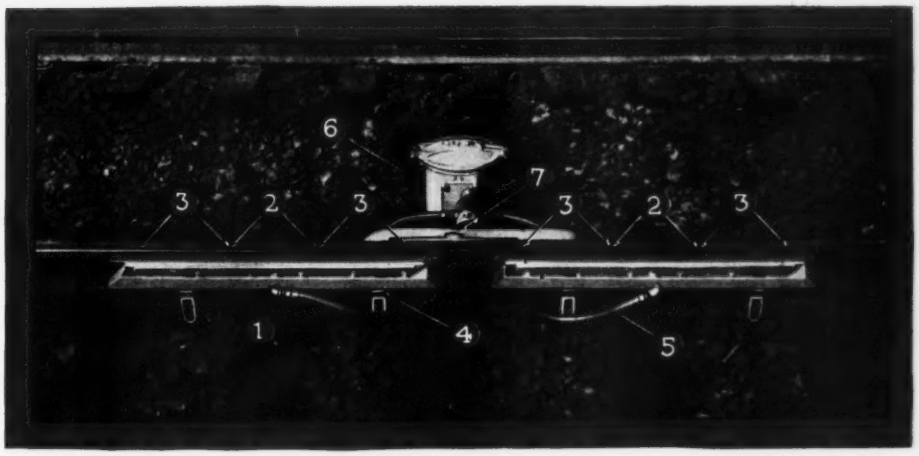
DECREASE Maintenance Labor, Rail and Tie Renewals, Wheel Flange Wear, Curve Friction, Train Resistance, Fuel Consumption, Derailment Hazards.

INCREASE Safety, Rail and Tie Life, Allowable Train Speeds, Tonnage Ratings, Locomotive and Car Wheel Life.

Meco Lubricators are actuated by the wheel treads, not by the flanges, and therefore lubricate just as positively and uniformly on wheels with worn or sharp flanges as on new wheels.

Practical design, rugged construction and positive, uniform service under millions of wheel contacts, enable us to guarantee that Meco Lubricators will work satisfactorily under all roadbed, track, traffic, temperature and climatic conditions. Let our experts analyze your curve territory and show what Meco Lubrication will save you.

MECO RAIL AND FLANGE LUBRICATORS



- No drilling necessary. Rugged universal clamps fasten MECOS to rail.
- Graphite Paste Lubricants function satisfactorily the year round.
- Lubricant equally distributed around *entire* circumference of Wheel Flange.
- Lubricant Distributing Bars are adjustable to suit various conditions of rail and train service.
- Small volume of lubricant on discharge side of pump prevents wasteful "surging" of lubricant after train has passed.
- Lubricant easily replenished. Closed container insures protection from rain or foreign material.
- Tread operated pumping mechanism, easily adjustable.
- Rugged construction throughout.

Over 3300 of our Rail and Flange Lubricators have been installed on more than 95 railroads, and more than 2700 of these are of the Meco design.

Pioneers in the Development of Rail and Flange Lubricators

MAINTENANCE EQUIPMENT CO

Railway Exchange Bldg.

CHICAGO

COMPLETE RAIL JOINT PROTECTION

The most severe corrosion of rail occurs in the joint area.

This corrosion, as well as that of splices and fastenings, is prevented by the Railway Maintenance Corporation's method of packing the joint, under pressure, with a plastic metal preserving compound.

Packing is done rapidly and economically without removing splices.

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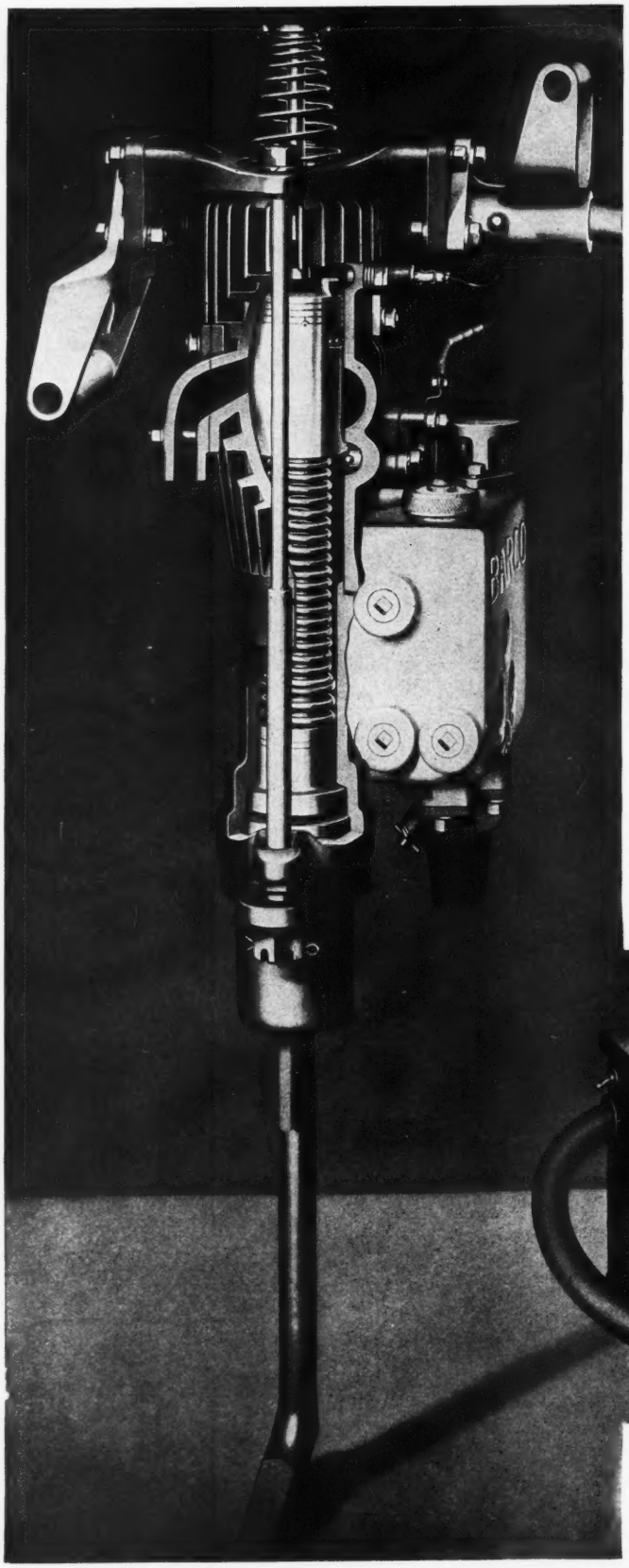

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No. 106 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Associations

Dear Reader: October 1, 1937

"How can you afford to give so much time to the Roadmasters Association? I have long noticed how you have assisted in the preparation and editing of the reports of committees, in securing speakers to address our conventions, and in a hundred other ways. It must take a lot of your time." This was the comment made to me a few days ago by an officer of this organization.

"Yes, it does take a lot of time," I replied, "but I feel that it is time well spent in many ways." In the first place, I and my associates believe in the Roadmasters Association and its companion organization, the American Railway Bridge and Building Association, as we do in the American Railway Engineering Association. We believe that each of these organizations has a specific place in the railway picture, a place that no other organization can fill.

Take the Roadmasters Association, since it was first mentioned. For 54 years it has provided a forum for the study and discussion of the newer developments in track maintenance from the standpoint of the man directly in charge of the field forces. These discussions have provided an educational service of far-reaching importance to the railways, an objective with which we of Railway Engineering and Maintenance have much in common.

Then again, I have seen instance after instance where work on committees or official responsibility has brought to the fore men of great practical ability but who were largely unknown even on their own roads. Through such activities these men have gained new confidence in themselves and greatly increased their value to their roads because of the enthusiasm and the inspiration which they have gained through collaboration with men of like interests.

Another reason why we believe in these associations is the fact that, as they achieve stability, railway supply companies recognize the opportunity that arises for the exhibition of their products to these men. Thus, the Track Supply Association has developed an exhibit that affords roadmasters and higher maintenance officers a valuable opportunity to study at first hand equipment and materials which they might not otherwise be able to see on their individual railroads.

And then there is the friendship that grows with contact with red-blooded men of action—roadmasters who accept a blizzard or a washout as a challenge. Many of these men have given freely and loyally of their time and energy to the work of the association. It is with these men that we have worked in building these associations. In my connection with this group for more than a quarter of a century (this year's convention is my 27th consecutive convention) I have known and worked with such stalwarts as Pat McAndrews, Jim Sweeney, Andy Clough, Coleman King, Mike Burke and others who have passed on, as well as men of like calibre who are still in the harness.

For all of these reasons I and my associates are glad to co-operate with the Roadmasters Association and with other associations in bringing their activities to the highest possible level of service to their members and to the railways from which they come. We believe in these associations. We believe they are doing a worth while job. We believe they are entitled to the support of the railways. Above all, we believe that they are entitled to our co-operation.

Yours sincerely,

Elmer T. Howson

ETH:EW. Editor

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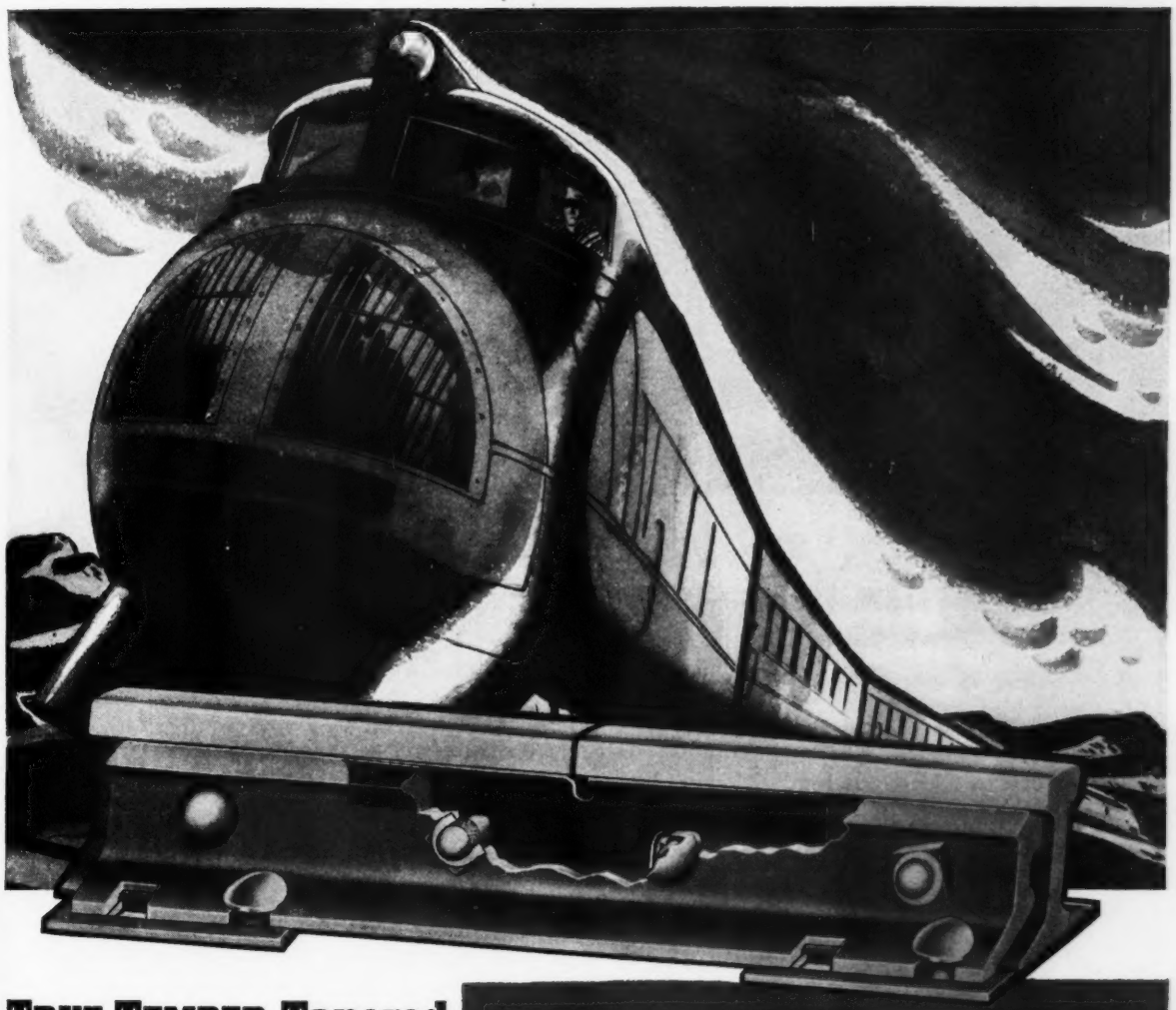

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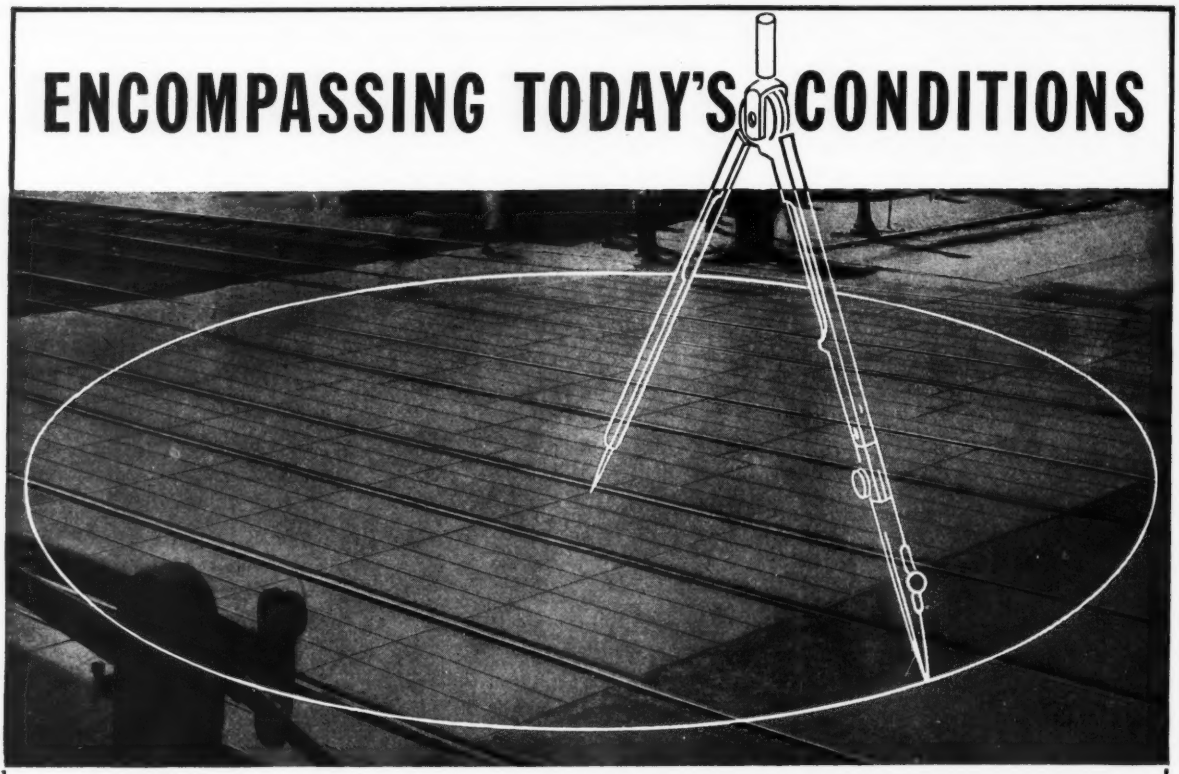

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Railway Engineering and Maintenance

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October, 1937

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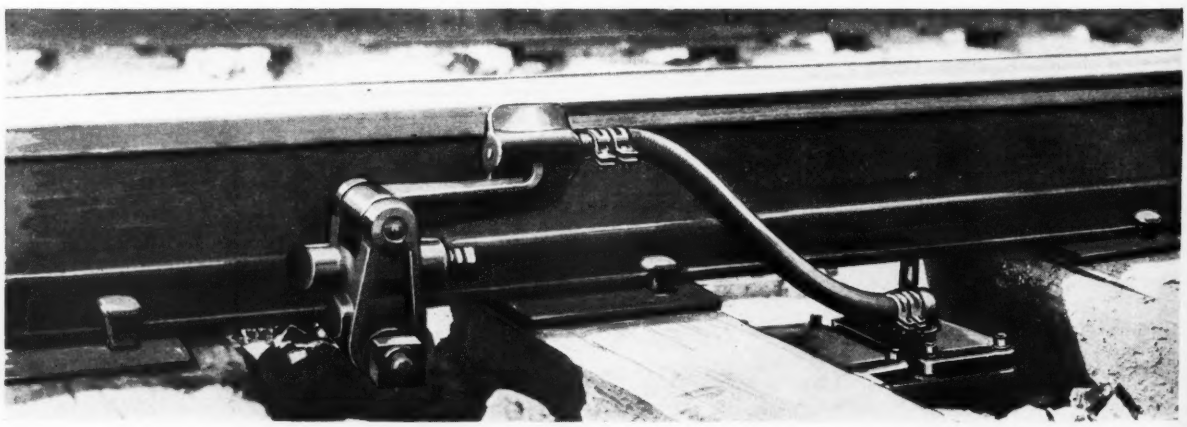


Railway Engineering and Maintenance

"It Can't Be Done"

But the Railways Prove It Can

THESE are changing days. Little is fixed. Everything appears to be in a state of transition. Old methods are giving way to new. And with these changing days come new demands.

Nowhere is this era of change more true than on the railways. The flexibility of the highway vehicle and the speed of the airplane have changed the public point of view towards transportation. Reduced inventories have changed the size of shipments; they have likewise added to the necessity for speed and dependability in their handling to the consignee.

A Defeatist Attitude

These evidences of the changing day require adjustments in the railway point of view that are not easy to bring about. The railway executive who told a group of shippers a decade ago that when traffic sought the highways the railways had no recourse but to resign themselves to its loss, reflected the sentiment of a large group of fellow railway officers.

Likewise, the officer who heaved a sigh of relief when he saw a large part of his less-than-carload traffic go to the trucks because "it was not paying its way any way," found many who shared his views. And the officer who saw in the diversion of passenger traffic to the buses an opportunity to reduce train miles and cut expenses, was likewise typical of many.

Such thinking followed the natural impulse. It was the easy way out of an increasingly difficult problem. But if pursued to the end, it could terminate only in disaster for the railroad industry.

Or a Challenge

Fortunately for the railways there were some in responsible positions who did not subscribe to this defeatist attitude but who accepted the new demands as a challenge to their intelligence and ability. They realized that from its very beginning the railway industry had been an industry of constant change and that its success over the years had been measured by its ability to adapt itself to new conditions. They saw in the demands of our day an opportunity to revise old services and to provide new ones that would open new avenues to the railways. They no longer considered the railway sphere of activity as confined between the right-of-way fences.

What has been the result of this attitude? It is reflected in the most varied and aggressive programs of rehabilitation of railway service that the country has ever seen—a transition that, although still in its early stages, is already winning warm commendation and increasing patronage from the public.

Passenger Service Goes Modern

Take passenger service for first consideration. One can now board a train in Chicago any evening and arrive in Denver, more than 1,000 miles distant, only 16 hours later—merely an overnight ride now, whereas less than two years ago it required 26 hours. Or he may arrive on the Pacific Coast in 39¾ hours, a full 24 hour less than was required by the fastest trains of five years ago.

And this speeding up of trains is widespread. The Association of American Railroads has found that whereas there were only 30 trains operating a combined total of 1,100 miles a day on schedules of 60 miles per hour or faster as recently as 1930, there are today more than 400 trains covering in excess of 19,000 miles a day at such speeds.

Furthermore, these trains are being built and equipped with comforts far exceeding those of the average home. Individual seats of most comfortable design; the latest in lighting, even to the use of tinted glass in the windows; the most modern lavatory and toilet facilities, all add to the comfort of the traveler. Above all, air conditioning has progressed to the point where practically every through train is so equipped and air-conditioned cars are appearing on many local trains. The rapidity with which air conditioning has been accepted by the railways is not equaled by that of any other industry.

Freight Service Revolutionized

In freight service the improvement, although less spectacular, has been equally marked. Where formerly this traffic was handled in drag freight trains and was held until sufficient tonnage was available, it now moves with clock-like regularity on schedules that are as definite as those of passenger trains. Furthermore, the speeds of these trains have been so increased and the delays in terminals and elsewhere have been so reduced that the

average movement of freight trains has been stepped up 44 per cent in the last 15 years. In other words, approximately 3 hours has been cut from the average time required for freight trains to travel 100 miles. Since the average haul approximates 200 miles, the total saving in time required in transit averages 6 hours. When it is considered that this saving is spread over some 750,000 cars loaded per week, the contribution that the railways of the country are making to the acceleration of business is evident.

Again, one may contrast the former universal practice of requiring the shipper to bring his l.c.l. freight to the railway station and to take it away, with the complete service that the railways offer today from the door of the shipper to that of the consignee. This is typical of numerous improvements in service that are now being introduced and of still others on which alert railway men are devoting their attention, all contributing to the renaissance of railway transportation.

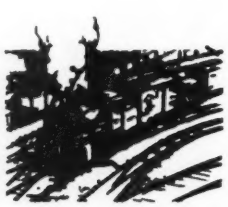
Not in the Books

The trouble with many people in all walks of life today is that they think that all of the information is to be found in "books." Yet the people who are making progress in the railway industry today and those who have made the most progress ever since the railways began are those whose new methods are constantly making it necessary to bring out revised editions of the old "text books." The rapidity with which railway text books are becoming obsolete today reflects great credit on those in charge of the transportation systems of this country. It should likewise be a source of great pride to every employee of the railways.

Water Treatment

Change in Attitude Has Been Beneficial

THE recent completion of large water softening plants by two middle western railroads and the fact that a third railroad in the same general territory has recently made studies for a similar project, demonstrate in no uncertain terms that the railroads are constantly finding new opportunities for improvement in the quality of locomotive boiler water. Current activity in this field can be ascribed only in part to a dammed up demand resulting from the suspension of construction during the depression, because a number of large water softening plants were built, and improvements of a less costly type were made during the period of most drastic retrenchment. Furthermore, it is necessary to bear in mind that the volume of traffic at the present time is still appreciably less than it was prior to 1931, so that current expenditures for water-treating facilities cannot be explained in most cases by inadequate capacity of existing plants.



In general, therefore, the real reason for current appropriations for facilities designed to improve the quality of boiler waters is to be found in the more exacting demands imposed in locomotive performance from the standpoints of both economy and reliability. As a result it is being found profitable, if not absolutely necessary, to treat water today of a quality which only a few years ago was deemed satisfactory for use in its raw state.

The attitude toward water treatment has changed also in other respects. Twenty years ago opinions were sharply defined; champions of the roadside treating plant denounced internal treatment, while those who favored the latter were just as positive that expenditures for softeners were a waste of money. But this dogmatic approach has largely disappeared, thanks to a greater knowledge of both the scientific and practical aspects of the problem on the part of railway officers and to the removal of the aura of mystery with which the manufacturers of proprietary compounds formerly surrounded their products. As a result, it is now the consensus of men in charge of water treatment that there is no one panacea for water troubles. They realize that what is the right answer in one case may not solve the problem in another. Because they have been more open minded in their studies, advance in the treatment of water has been more rapid of late than it was in the past.

Two Associations

Do the Railways Appreciate Their Value?

WHILE the Roadmasters' association is the oldest organization of maintenance of way officers in America, it carries that distinction by a matter of only eight years, for its companion organization, the American Railway Bridge and Building Association, which meets in Chicago next month, will celebrate its golden anniversary in 1940. Born in the same period of railway expansion, both associations arose out of similar needs for an opportunity to meet and exchange views and to develop common practices in their respective fields.

Although the work of the two associations is distinctive, since each represents a specialized field, that they have much in common is evidenced by the fact that not a few maintenance officers belong to both. That both stand high in the estimation of railway management is indicated by the fact that during the World War they were among the few railway organizations that were permitted to continue their annual meetings. Again, following the suspension of association work which was brought about by economic conditions subsequent to 1930, these two organizations were among the first three that were permitted to resume their activities.

It is of interest to study the characteristics of any organization which has survived the turbulent half century through which these associations have passed. In any such examination of these two organizations certain facts stand our clearly Those who were responsible

for their birth recognized that to justify its existence an organization must have an objective, and that to command respect it must build a record of constructive accomplishment. That the influence of these early leaders has not been allowed to lapse is indicated by the fact that both associations, one after 47 years and the other at the end of 55, are able to retain the loyalty and sustain the interest of their members, and that both can point to almost unbroken records of accomplishment during their periods of existence.

Those who are most closely in touch with their work are aware that they were never more alert than they are today and that the character of their work is improving. In the earlier years there was little experience to guide them, and some of the reports and discussions of those days do not show evidence of the intensive study and constructive thought which have characterized those of later years. Despite this, both organizations have had a profound influence in their respective fields, and as each year's work has been added to the volume of the past, it has acted as a stimulant to better and more constructive effort.

It would be difficult to choose between the two organizations in their value to the railways. The results of participation in association work and attendance at conventions is partly educational and partly psychological. The first broadens the viewpoint through knowledge of what others are doing and thinking; the second stimulates the imagination and creates an urge to think out problems in a new way, as well as an enthusiasm for the individual's work which the persistent stay-at-home never experiences. For this reason, any railway which stands back of its men and urges their participation in these activities is certain to receive a return out of proportion to the cost it assumes for such participation.

Higher Speeds

Do They Increase Track Labor Costs?

THE MAINTAINING of track for high-speed passenger trains is a subject that as recently as two years ago was of little more than academic interest to most maintenance officers. But even in this short period, the rapid extension of shortened schedules is arousing concern in the minds of not a few officers who have had no expectation that they would be called on to meet the problems of track maintenance which these high-speed trains present.

With the advent of higher speeds, even on heavy-traffic main lines which were already carrying important through passenger trains, it has been found essential to raise the standard of track maintenance, particularly with respect to line and surface, and to place particular emphasis on curves. In not a few instances, however, this service is being extended to include secondary lines, thus increasing the perplexities of maintaining the track to the required higher standard. On such lines the standards are likely to be somewhat lower, that is, the rail is older, the ballast section is lighter and less attention has been paid to line, surface and uniformity of curve elevation. On such lines the first problem is to educate the maintenance forces to a new viewpoint with respect to refinements in line, surface and curve maintenance.

Other conditions being equal, it is obvious that as train speeds increase, maintenance costs must rise and that the refinements in maintenance demanded by high-speed trains will increase these costs still further. It is also obvious that this increase will be greater on a line of previous low standards than on one which has long been maintained to a high standard. That is, it will be larger on a secondary line where smooth riding has not been considered of great importance, than on a primary line having considerable passenger traffic.

A committee of the American Railway Engineering Association, which studied this problem recently, reported that the higher standards and greater refinements in maintenance demanded by high-speed operation increase the labor cost of track maintenance on primary lines about 10 per cent. No further increase is required where lightweight equipment and specially designed locomotives, either Diesel or steam, are operated. Labor costs may be increased somewhat more than this amount where standard equipment is operated at high speed.

On the other hand, the committee concluded that, because of the greater damage created by freight equipment, labor costs for track maintenance may be increased by as much as 25 to 50 per cent, depending on the number of such trains, the speeds at which they are operated and the design of the locomotives used to pull them. It is a matter of common knowledge that few locomotives in freight service today are designed for the speeds at which many of them are being operated, with the result that they are highly destructive to track and create excessive disturbance to line and surface.

It is not the purpose to minimize the importance of the task which confronts maintenance officers as a result of the development of high-speed trains, for smooth riding is an essential of their operation, and to produce smooth-riding track at high speed ramifies into every phase of track maintenance. It is no easy task, too, to change, almost over night, the viewpoint of maintenance forces who have been trained through long years of service to a different standard of track maintenance.

What it is desired to emphasize is that these higher speeds have brought about no fundamental change in the form of track construction, in the organization of the maintenance forces or in the methods of maintenance. They have created a need, however, for more alert attention to small defects in line and surface and for more intensive supervision of track maintenance. It is also a matter of encouragement to those who have not yet been, but who may be, called to meet the problems of track maintenance under high-speed service to know that this work can be done with so little increase in cost.

Painting Has Been Sadly Neglected

Buildings—The Most

RAILWAY buildings have been the "stepchild" among railway facilities during the last seven years. That they have been neglected generally, few railway men will deny. In fact, building department men on many roads feel that they have been the "forgotten men" during the depression. As pointed out editorially in the May issue, the comment of most maintenance of way officers concerning the status of the properties under their charge ends with the same general admission, "but we are still far behind in our building maintenance, especially in painting." The question now is, whether most of them fully appreciate how far behind they really are? Indications are that they do not, and cannot until they get into the work again and start to tear out and uncover.

In round numbers, there are approximately 365,000 buildings on the railways, ranging in size and importance from watchman's shantys and outlying tool houses to large passenger and freight terminal structures. Again, in round figures, after allowing for the retirement and removal of many buildings in recent years, $304,000,000 *less* was spent for the maintenance and repair of railway buildings during the seven years 1930 to 1936, than was spent during the seven-year period immediately preceding. If these figures indicate anything, it is that those in charge of building maintenance on the railways are confronted with a real problem, which daily becomes more aggravated as adequate attention to buildings is further delayed.

Just what is the status of building maintenance on the railways? How serious is the problem of deferred maintenance at the present time? What can be and is being done about it? These questions are discussed briefly in this article.

A Look at the Record

During the recent prolonged period of depressed earnings on the railways, curtailment in the normal upkeep of their extensive building properties presented an immediate large opportunity for retrenchment which could be taken advantage of without affecting the safety of rail transportation in any way. In this regard, it was realized that building maintenance could be deferred over a reasonable period of time with little offense to the public, and with little injury to the buildings themselves. However, as year after year has gone by with continued curtailed building repair programs on many roads, the maintenance officers of these roads have become seriously concerned.

To what extent has building maintenance been curtailed? The record speaks for itself. According to statistics compiled by the Interstate Commerce Commission, the annual average expenditure for the maintenance of railway buildings during the ten years of 1920 to 1929, inclusive, was $85,171,800, whereas during the seven years 1930 to 1936, inclusive, the yearly expenditure for building maintenance was only approximately $42,000,000, or less than one-half as much. All classes of buildings were affected in this drastic cut. In the earlier group of years referred to, the average expenditure for the upkeep of shops and engine houses was approximately $24,835,000 a year, whereas from 1930 to 1936, the yearly expenditures dropped to less than $12,000,000. In these same groups of years, expenditures for the upkeep of miscellaneous roadway buildings dropped from an average of $4,847,000 to $1,908,000.

Even passenger stations and office buildings were not spared in the drastic retrenchment brought about, the record showing that whereas approximately $32,181,300 was spent yearly on these classes of buildings between 1920 and 1929, only approximately $16,150,000 was expended annually for their maintenance during the years 1930 to 1936, inclusive. Nearly all of the figures show a reduction in expenditures of one-half or more, a fact which cannot be regarded lightly when considering the present status of railway buildings and the work which must be done to restore them to good condition.

Neglected Facility

on the Railways

During the last seven years, the amount of money spent for the repair and upkeep of railway buildings has been cut in half, and betterments to railway buildings have been largely at a standstill. In this period, more than $300,000,000 of maintenance money has been diverted to other purposes. Necessary as was this neglect of buildings, the situation created, as is pointed out in this article, is one which now requires early attention if grossly excessive repair costs are to be avoided.

It may be said that the amounts spent for building maintenance during the more prosperous years of 1920 to 1929 do not offer a fair basis of comparison, and yet, who will contend that railway buildings were over-maintained during those years? It is recognized that expenditures for building maintenance during 1936 were somewhat larger than during the years immediately preceding, and that the expenditures being made in 1937 may exceed those for 1936, but it should be remembered that even the combined total expenditures for these *two* years of somewhat improved conditions are not likely to exceed the expenditures for building maintenance in any *one* of the years 1926 to 1929 alone. It is also recognized that the fact that many railway buildings have been abandoned or dismantled during recent years will be reflected in lower maintenance cost in the future. But again, will anyone contend that these facts will have more than a minor bearing upon the building maintenance problem confronting the railways as a whole at the present time?

Buildings, of course, were not the only units of the fixed properties which suffered under-maintenance during the depression. Necessary reductions in expenditures were made all along the line, in every phase of maintenance, with the exception in many cases of important main-line tracks. However, it should be noted that whereas much of the deferred maintenance of the track has already been overcome through increased expenditures and attention during the last year or two, building work still lags seriously.

At a Standstill

Added to the woes of the building departments of the railways is the fact that throughout the depression, while building maintenance lagged, needed building additions, and betterment and alteration projects were practically at a standstill on most roads, and the further fact that little has been done about it yet. This situation has prevailed at a time when through obsolescence, brought about by changed operating conditions and the reorganization of facilities and forces, an unusually large amount of building work has been called for, the continued delay of

At the Right—This Is by no Means an Extreme Example of Building Neglect on the Railroads

which is affecting adversely the efficiency of many railway operations and the good will of many railway patrons and friends.

No Criticism Implied

This situation as regards the condition of railway buildings implies no criticism of railway officers. Confronted with the worst depression in the history of the country, which saw revenues drastically curtailed and deficits piling up in many cases, it became the first obligation and duty of these men to apply such funds as became available for the upkeep of tracks, equipment and other revenue-producing facilities, especially where the element of safety was involved. Following this policy, the railways, during the depression years, built up for themselves a most enviable record of safety and of improvement in rail transportation, which offers further convincing evidence of the high degree of efficiency of present-day railway management.

It is a well known fact that as regards building maintenance, some roads are much further behind than others. Some roads were fortunate enough throughout the depression to be able to spare other than the "crumbs" for the care and upkeep of building structures. Others, with officers more "building minded," found sufficient funds to keep buildings in a fair state of appearance and repair. As a matter of fact, some few roads will admit little deferred building maintenance, even though expenditures for the care and repair of their buildings have been reduced materially.

During the last year or two, some increased attention has been given to buildings on a number of roads. This is evidenced by the slowly increasing expenditures for building maintenance by the railways as a whole. It is also evidenced in the article in the August issue describing the sizeable program of building repairs which is now underway on the Wabash. On certain roads, however, the neglect of building structures has continued for no apparent reason, while on still other roads there is, obviously, still little money in sight for building work. In any event, however, it should not be overlooked that continued delay in building maintenance must inevitably reflect itself in abnormally high building repair costs. Unfortunately, building deterioration goes on almost regardless of traffic considerations. During the lowest point in the depression the elements continued to take their toll. At the same time, as required repairs and painting were neglected, the character and extent of the deterioration in many cases became more serious and the rate more rapid.

Left—Roofs and Gutters Have Been Seriously Neglected. Below—The Drinking Water Facilities at This Town Have Been Out of Order for Two Years

Much Deterioration Hidden

In view of this, many railway men, including some building department officers, should be prepared for an unwelcome surprise when they finally resume building repair work on a sizable scale. With even periodic inspections curtailed in many cases as a result of force reductions, it is questionable whether many roads fully appreciate what has been taking place in building deterioration. Where there have been inspections many of them have been casual. With little or no money in sight, there was little point in knowing true conditions. Even specific complaints of the public have been sidestepped where possible. The buildings were kept safe, but little more could be done.

Overrun Estimates

About two years ago, one road, contemplating a delayed program of building repairs, made an inspection of its buildings and drew up estimates of the costs of the more urgent repairs and improvements required. During the present year, as this program continues on a sizeable scale, it is finding that the costs involved at each particular building are running an average of 40 per cent above the earlier estimates, due to some extent to the increased costs of materials and labor, but more largely to increased deterioration since the inspection upon which the estimates were based, and to unexpected work uncovered as repairs progress.

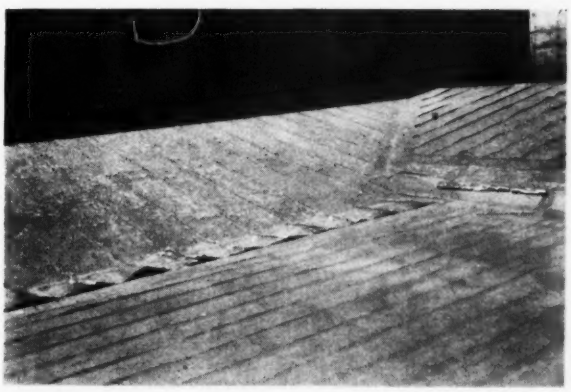
Miscellaneous Roadway Buildings Are in Need of Attention on Many Roads

Leaking roofs have, in many cases, caused the rotting out of roof sheathing and have damaged interiors. Defective plumbing has damaged floors and walls. Lack of adequate drainage about buildings and platforms has accelerated the decay of many timber footings and foundations. Neglect of painting has increased the cost of preparatory cleaning and the application of the paint itself. In addition, the necessary tearing out in connection with authorized repairs is disclosing decayed

floor and platform joists; corroded, leaky flashing; plumbing which demands attention while alterations are being made; and a multitude of other types of repairs and renewals, which, though frequently limited in extent in themselves, appreciably affect the total cost of the work.

"Dressing Up"

In spite of this increased work being done, this road recognizes that at many points it is, figuratively speaking, only "dressing up," that is, attempting to achieve the most pronounced improvement in appearance with the least possible expenditure. At a later date it hopes to be able to install plumbing and sanitation at points where the demand for such has been urgent, and at other points to rip out antiquated plumbing and toilet facilities which are anything but becoming to the railroad and pleasing to the public. At certain places, if funds permitted, it would like to modernize heating plants, from the standpoint of both appearance and economy of operation, and at several points it would like to modernize and expand facilities more in keeping with present-day architectural treatment and traffic demands.



No One Remembers When This Metal Roof Was Last Painted

Modernization Often Pays

In any early programs of building work, many roads, of necessity, must give primary attention to most urgent repairs, but at the same time, these programs should not overlook the importance of increased public good will through improved appearance. In this latter regard, improvements may reflect tangible and intangible benefits to the railway, far beyond any costs involved in the work. At the same time, suitable alterations and repairs may effectively overcome insistent demands for new station facilities, as is the case at one point on an eastern road at the present time where an alteration project costing approximately $200,000 has satisfied a long-standing insistent demand for a new station building that is estimated to cost in excess of $1,000,000.

For the possibilities in building modernization, the railways need look only to the general building industry, wherein there are thousands of striking examples of what can be done in the way of building modernization at relatively small cost. That some roads have not overlooked the possibilities in this regard is indicated by the example cited above and also by the article which appeared in the April issue describing how the Milwaukee completely modernized its old station at Winona, Minn., at moderate expense, and thereby overcame a demand for a new station building that would have cost an amount entirely out of line with the passenger revenues from the town.

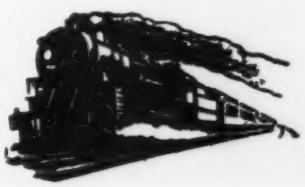
Another case is that of an eastern road which recently renovated and modernized an old two-story brick-faced passenger station, built in the Eighties, with an expenditure far below the estimated cost of a new station of the character that would have been required. In this job, Victorian gables and overhanging eaves were removed, the interior was replastered or otherwise refinished, and the entire exterior was faced with cement stucco. With other related improvements in the way of new sanitary facilities, new platforms, etc., the road has a substantially new station building, entirely satisfactory to the public, provided with a relatively modest outlay of funds.

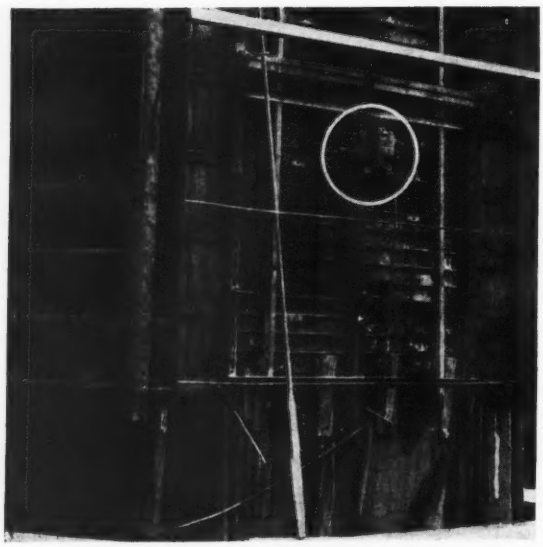
Improvements in Materials

In any programs of building repairs or alterations, the extensive improvements which have been made in building materials and equipment in recent years should not be overlooked. These improvements affect building construction from roof to foundation—in more attractive, durable and fire-resistive roof and exterior wall coverings, more serviceable and attractive interior wall finishes and flooring materials, more sightly and sanitary plumbing facilities, and more appropriate and economical heating equipment, not to mention the possibilities for improvements in the way of modern trim, decoration and furnishings. Then there are such materials as temperature and noise insulation, the use of which has been given little consideration in railway building construction. This is particularly true of temperature insulation, except for cold storage warehouses, in spite of the fact that this material offers large possibilities at many points for providing increased comfort for patrons and employees, and may be used in many instances with little or no additional first cost, and not infrequently with actual economy.

To cite only one example—a road recently insulated an office floor located over a large unheated freight-handling area, with increased comfort to the office employees who had long complained of a cold, drafty floor, and with considerable economy in the expense for heating the office area. The insulation was applied on the under-side of the floor, working from the freight-handling area, and the cost was modest in view of the results accomplished.

The railways, both as regards patronage and earnings, are definitely on the ascendency. Much still must be done to restore their physical properties, and especially buildings, to the desired level warranted both by public considerations and the desirability of cutting routine maintenance costs to a minimum. Lack of available funds has been the major factor retarding building work for a number of years, and the unfavorable situation created has thus been largely unavoidable. However, as earnings increase, maintenance officers must, of necessity, promote more consideration of building maintenance with their managements, and become more liberal themselves toward needed building work in the division of such general maintenance funds as are made available.





An Exterior Vibrator Clamped to a Wall Form—in the Circle

Good Results With Vibrated Concrete*

Example of an Interior Vibrator

AS KNOWLEDGE of and experience with vibratory placement of concrete increase, it is becoming apparent that an intelligent use of vibratory equipment is necessary not only to obtain best results, but also to obviate unsatisfactory results. No direct relation between the mobility or consistency of concrete to be vibrated and the optimum energy for its vibration has yet been worked out. Nor has the mass that may be considered properly vibrated been related to either the energy or speed of vibration. Investigators have, however, reached a consensus that high speed vibration has marked advantages over low speed, both in the period of application and the results obtained. Equal or better results can be obtained in less time with high frequency than with low frequency. There is enough evidence available to show that specifications may properly call for a frequency of not less than 5,000 per minute and that better results may be expected from still higher frequencies.

A job study should always be made to determine the proper mix and time of vibration. The result of using a mix that is not suited to placement by vibration will be unsatisfactory. The error is usually on the wet side. Concrete too stiff for proper hand working may be plastic and placeable with vibration. While high-sanded mixes are desirable for hand worked concrete, they are neither economical nor desirable for vibratory placement.

A suggested procedure to determine a suitable mix for vibratory placement is as follows:

Start with a mix having the amount of water indicated by the specified water ratio and about the same sand proportions as for hand working. The slump should not exceed 3 in. to 4 in. for other than very restricted placement where external vibration only is practicable. With well-graded aggregates, a fine-to-coarse aggregate ratio of about 35 to 65 is a good starting ratio to use. If on application of vibration, mortar quickly appears at the surface or along the forms or around protruding reinforcement bars, the mix may be changed by reducing the sand and increasing the coarse aggregate so as to increase the total aggregates. When this process is carried to the point where the mix is too harsh or where there is "bleeding" or coarse aggregate segregation in handling, more sand should be added to bring the mix back to the consistency for proper placement. In adjusting the mix, it should be noted that that portion of the sand passing a No. 50 sieve, is more effective in plasticising

A Pneumatic Hammer Being Used to Vibrate Concrete for a Thin Type of Bridge Floor

*A report presented by the Committee on Masonry of the American Railway Engineering Association at the convention in March. L. W. Walter, inspecting engineer, Erie, Jersey City, N.J., was chairman of the subcommittee that prepared the report and Meyer Hirschthal, concrete engineer, Delaware, Lackawanna & Western, Hoboken, N.J., was chairman of the entire committee.

the mix and in preventing bleeding, than coarser sand.

Observation of the effect of vibration is the best guide to the proper period of its application at one location. If the concrete has flattened out and ceased to flow, or, if level at the beginning of vibration, the appearance of cement paste at the forms and reinforcement, are indications that no further benefit will be obtained and possible detriment will result from continuation of vibration.

The following rules pertaining to the use of vibrators have been found to be a guide to inspection and to planning construction operations involving their use.

Vibration is concerned primarily with plasticizing and compacting concrete that is dryer than can be worked properly and economically by hand. It should not be used primarily to cause concrete to flow horizontally.

Successive insertions of internal vibrators should be made so that the visible effects of vibration overlap; that is, the areas of impules from the vibrators should overlap.

Internal vibrators should be withdrawn slowly, especially when used with the drier mixes.

The minimum period of internal vibration at one location may be assumed as 15 seconds per square foot of top surface layer, computed on the basis of the radius of the overlapping impulses. A longer period may be required.

Dry consistencies will require more vibration than the wetter consistencies.

External vibrators should preferably be of high frequency and low kinetic energy of impulse.

Pennsylvania Constructs Novel Grouted Bank Revetment

AS WILL be remembered, the flood of March, 1936, created widespread damage to the eastern railways, destroying tracks and bridges for many miles, in some instances at places where no trouble had ever been experienced previously. Some of the severest damage occurred on the Pennsylvania east of Altoona, Pa., where the railway follows the Juniata river for 110 miles. This river, although having many of the characteristics of a mountain stream, normally gives little indication of the raging torrent that it became during this flood.

In this section the tracks are far above the normal flow line of the river, and in many places they swing well away from the channel. In general, the shoulders of the roadbed are wide and at numerous points, either as a precaution against possible flood erosion or as a result of trouble experienced previously, heavy riprap has been unloaded on the slopes of the embankments. Despite the elevation of the tracks above the normal flow line of the river and the efforts that had been made to protect the roadbed from stream cutting, the high water of March, 1936, washed out the roadbed, completely or partially, in several places.

One of these was at Jack Narrows, near Mount Union, Pa. At this point the roadbed was eroded to a depth of 20 ft., dropping the outer track of the four-track line and endangering operation on the next two tracks. Here the line follows a bend of the river on a curve of long radius, and the possibility of future erosion prompted the use of revetment after the embankment had been restored. The method of constructing this revetment is one of the interesting features of the later work, after traffic had been restored and the water had subsided, to provide protection against future floods.

After the embankment was restored, a dry rubble toe wall was built at the foot of the slope in the river. This wall was constructed of large stones which were unloaded from cars and allowed to roll down the slope, and it rests on the natural rock which forms the bed of the Juniata river at this point. After the loose-rock toe wall was finished, blast-furnace slag, ranging from 1 in. to 3 or 4 in. in size, was dumped on the slope to a depth of 2 ft. at the top and 3 ft. at the toe wall. The surface of the slag covering was then leveled off as uniformly as practicable, at about its angle of repose.

The voids in the slag were then filled with a grout composed of 1 part of portland cement and 3 parts of sand somewhat finer than that ordinarily used in concrete. The mixer was operated from the shoulder of the roadbed, which was wide enough to provide clearance for it and the necessary materials. The grout was delivered directly from the mixer through troughs to the surface of the slag and allowed to run down the slope.

To determine whether the penetration and distribution of the grout was being made satisfactorily, holes were dug into the slag blanket at frequent intervals. These inspection holes revealed that the grout ran freely through the slag by gravity for considerable distances and that it penetrated to the full depth of the blanket.

Left—Restoring Fill at Jack Narrows on the Juniata River After the 1936 Flood

Right—Completed Bank Revetment at the Location Shown Above

No attempt was made to produce a smooth surface, but at the angle of the slope it is quite difficult to climb it, except at places where protruding slag nodules afford a foothold.

It was not along the Juniata river only that the Pennsylvania suffered from bank erosion and washouts, for similar damage occurred along the Conemaugh river. At three places along this latter stream where the roadbed was washed out, the same general type of bank revetment was constructed. Two types of toe wall were used along the Conemaugh, however, these being grouted slag and grouted rubble. Another method of binding the slag blanket was also tried out at one point. This consisted of mixing fine lime slag with the coarse furnace slag, the idea being that the finely divided lime slag would harden sufficiently on exposure to bind the coarser furnace slag together.

The cost per square yard for these revetments has ranged from $1.75 to $2 for cement, sand and labor, exclusive of the toe walls and the slag blanket. The toe walls would have been required in any case to protect the base of the embankment and the slag merely replaces the same amount of filling which would otherwise have been required to bring the roadbed to the proper width. In fact, it seems probable that, except for other considerations of safety, the shoulder might have been reduced where this revetment was installed, so that the cost would have remained about the same as that of the wider shoulder made with ordinary filling material.

Piling Inspected With Increment Borers on C. B. & Q.

THE taking of increment borings from timber piling to determine the condition of the wood on the interior is a practice that is frequently employed during the inspection of bridges but rarely has it been given such wide use as it has in recent years on the Chicago, Burlington & Quincy. During the last two years this company has caried forward a project, now practically completed, which has as its objective the taking of increment borings from representative piling in every bridge on the system in which such members appear.

This project had its inception early in 1935 and was the direct outcome of the discovery of premature decay in some creosoted pine crossties. Since this discovery raised the question as to whether such decay might not also be present in piling it was decided to obtain a satisfactory answer to the question by making a check, through the medium of borings, of all bridges on the railroad containing piling. Consideration was also given to the fact that such an inspection would afford an opportunity of determining if the decay which had been discovered in stocks of untreated piling had made further inroads on the sound wood following treatment.

As the increment, or "core" borer, provided a specimen of the material being inspected that lends itself to ready examination it was decided to employ this device wherever possible. However, while this borer readily penetrates pine wood it can be forced into harder woods only with difficulty, and for this reason a ⅜-in. auger was used to obtain speciments from cypress and oak piling.

Each master carpenter on the railroad was supplied with an increment borer and instructed to take a specimen from one pile of each bent of all timber structures. If interior decay was discovered in any pile, borings were to be taken from all other piling in the same bent. In each case the boring was extended approximately to the center of the pile, and all holes thus made were filled with creosoted wood plugs. No definite rule was promulgated concerning the height at which the borings were to be made although, in general, the borings in the longer piles were made near the ground while those in the shorter piles near the ends of the bridges were taken near the tops of the piles. Thus, specimens were obtained from various heights in the piles without undue effort.

The borings from each pile were placed in a 3½-in. by 5½-in. brown paper envelope especially provided for this purpose, and sent to the bridge engineer for examination. To insure that the specimens could be properly identified, the envelopes contained spaces on one side for the insertion of such information as the division, the line, the town near which the particular bridge is located, the bridge, bent and pile numbers, the location of the test hole, the kind of timber in the pile, the kind of treatment, the condition of the timber as shown by the boring, the location and extent of the decay, if any, measured from the face of the pile, the name of the person taking the sample, and the date.

In the office of the bridge engineer the samples were examined and a notation of the findings made on the bridge list. While, as was expected, a certain amount of decay was found, the borings revealed that no bad general condition existed. When examination of the samples had been completed in the bridge engineer's office they were forwarded to the superintendent of timber preservation for further study.

No concerted effort was made to complete the test borings in a specified period, the master carpenters simply being instructed to work the inspection program in with routine bridge operations as opportunity afforded itself.

The actual work of making the borings was done by the bridge gangs, each master carpenter rotating his increment borer among the bridge foremen as the work progressed over the division.

This inspection program has had the effect of reassuring the Burlington concerning the condition of its piling, thus serving to dispel the uncertainty that was created by the discovery of the premature decay in ties. The program was carried out under the supervision of G. A. Haggander, bridge engineer.

A Year Ago as Roadmasters Waited for Their Train After Visiting Plant of the Carnegie-Illinois Steel Company

Photo by Robert White, Section Foreman, Grand Trunk Western, Saranac. Mich.

Best Since the Depression

Roadmasters' convention reaches new high level in attendance, interest and practical value of program, as well as in attractiveness of exhibit

THE fifty-second annual convention of the Roadmasters and Maintenance of Way Association, which was held at the Hotel Stevens, Chicago, on September 14-16, was the most largely attended since the pre-depression meeting in 1929, with more than 300 railway officers present and a total attendance, including exhibitors, of more than 700 men. The program was likewise of a high character and held the interest of those present throughout the sessions, while the exhibit was not only participated in by a larger number of companies but was more attractively presented than in any recent year. Contributing materially to the interest in the convention and the exhibit were meetings of the Board of Direction and of the committees on Rail, Track, Economics of Railway Operation and Maintenance of Way Work Equipment of the American Railway Engineering Association coincident with the convention.

The program included the presentation of reports by committees on The Maintenance of Rail Joints, The Housing of Track Labor, The Trackman's Responsibility for the Safety of Highway Crossings, Good Practice in the Laying of Rail to Secure Workmanlike Results, and The Operation of Motor Cars to Avoid Accidents. These reports were supplemented by addresses on The Curing of Soft Roadbed by A. A. Miller, engineer maintenance of way, Mo. Pac.; The Roadmaster's Responsibility for Tie Life by H. R. Duncan, superintendent timber preservation, C. B. & Q.; Building a Railroad for Today's Traffic by H. S. Clarke, engineer maintenance of way, D. & H.; and The Relationship Between the Stores and Maintenance of Way Departments by W. S. Morehead, general storekeeper, I. C., all of which papers and addresses are presented in the following pages, except those of A. A. Miller and H. S. Clarke, which will appear in the next issue. A special feature of the program was a Question Box session on Tuesday evening, at which questions submitted by members were presented for impromptu discussion. All sessions were presided over by B. E. Haley (general roadmaster, A.C.L., Lakeland, Fla.), president of the association, assisted by T. F. Donahoe (B. & O.), secretary, and C. A. Lichty (C. & N.W.), assistant secretary.

A dinner was given the roadmasters by the Track Supply Association on Wednesday evening, at which 450 persons were present. Following the Tuesday afternoon session, the members inspected the new Denver Zephyr streamlined train of the C. B. & Q. and the Streamliner City of Denver of the C. & N. W.-U. P., which were set in their respective stations to afford the roadmasters an opportunity to see the latest in railway passenger transportation.

At the closing session of the convention, W. O. Frame, assistant superintendent, C. B. & Q., Wymore, Neb., was advanced from first vice-president to president; A. H. Peterson, roadmaster, C. M. St. P. & P., Chicago, from second vice-president to first vice-president; C. A. Lichty, Chicago, from assistant secretary to secretary; and E. E. Crowley, roadmaster, D. & H., Oneonta, N. Y., was re-elected treasurer. In addition, F. B. LaFleur, roadmaster, Sou. Pac., Lafayette, La., was elected second vice-president. The directors elected included G. L. Sitton, engineer maintenance of way, Southern, Charlotte, N. C., and E. L. Banion, roadmaster, A. T. & S. F., Independence, Kan., for four-year terms; T. F. Donahoe, supervisor of road, B. & O., Pittsburgh, Pa., was elected a director for one year to fill the unexpired term of E. P. Safford, who resigned because of ill health, and W. H. Haggerty, track supervisor, N. Y., N. H. & H., New York, was elected a director for two years to fill the vacancy created by the elevation of Mr. LaFleur to second vice-president. Chicago was selected as the convention city for the 1938 annual meeting.

The following subjects were selected for consideration by commit-

tees during the ensuing year: The Maintenance of Line and Surface to Meet Present Day Operating Requirements; The Materials and Equipment for the Section Gang of Today; Methods of Instructing Track Men in Safety; The Maintenance of Turnouts; The Programming of Track Work; and The Elimination of Train Derailments Resulting from Track Defects.

H. G. Taylor Opens Convention

Harry G. Taylor, chairman, Western Association of Railway Executives, opened the convention with a message of encouragement from the executives. Congratulating the association on its long record of constructive service, he called attention to the development of the American railway system during this period, a development which, he said, could not be duplicated anywhere else in the world. Yet, he said, the railways are still in a transition period. Conditions are changing. Railway men must be alert to the new demands for service, alert to new developments of manufacturers. For these reasons, he characterized the present as the most interesting period in railway history.

Mr. Taylor characterized the annual conventions of this association as affording valuable opportunities to those attending the meetings to compare notes and study trends in methods and materials. The association has earned the confidence of railway managements by its serious attention to work during the years and its refusal to participate in convention "junketing" to distant cities. The problems of today are too serious, Mr. Taylor said, for any letdown for pleasure.

Where are the railways heading? Mr. Taylor said that he could answer this question if he knew that the railways would be let alone. The railways are inherently sound, he said. Nowhere in the world is the service so high. The danger lies in the constant piling up of legislative and regulatory restrictions, with the result that the railways no sooner adjust themselves to one new regulation than another new burden is placed on them. He urged the roadmasters to use every opportunity to acquaint the public with the problems of the railways. The railway record is one of achievement and courage that every railway man can be proud of. The public is friendly to the railways today but if railways employes do not tell their story to the public, they will find the railways so hampered by regulation that government ownership will be imminent. He closed with the statement that the railways should have opportunities as free institutions to serve a growing country as their past record and performance have demonstrated that they can.

Greetings

J. C. Irwin, president of the American Railway Engineering Association, presented the greetings of that organization and urged that the two associations work in harmony to make effective the findings of both. Mr. Irwin referred to the Division of Engineering Research that had just been formed by the Association of

B. E. Haley
President

Mr. Haley is general roadmaster on the Atlantic Coast Line in charge of its lines in Florida and with headquarters at Lakeland, Fla. He is representative of the large group of supervisory maintenance officers who have risen to positions of responsibility through the school of practical experience.

American Railroads as a forward-looking step that will do much to coordinate activities of the engineering and mechanical departments in the solution of problems. Mr. Irwin thanked the roadmasters for their assistance in putting into practice many of the conclusions adopted by the A. R. E. A. and now incorporated in that association's manual of recommended practices. Mr. Irwin also characterized as a constructive service to the railways the Questions and Answers department that has appeared monthly in *Railway Engineering and Maintenance* during the last 17 years, and referred specifically to the series of articles on the Standardization of Track Tools that appeared in this publication in 1934-1935 as a constructive service in promoting the more widespread use of standard tools.

C. Miles Burpee, vice-president of the American Railway Bridge and Building Association, extended the greetings of that organization and expressed the hope that "your deliberations and proceedings may be marked with that true spirit of cooperation and good will which has been so productive of beneficial results to so many of the railways of this continent for over half a century. During the last few years when the tremendous economic upheaval necessitated the adoption of and adherence to drastic measures of curtailment designed to enable our companies to weather the storm, the loyalty and perseverance of those actively engaged in maintenance of way have contributed much to the ability of our companies to carry on.

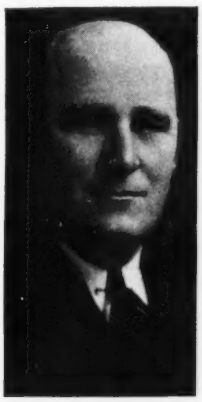
"The American railways have long been characterized by their conservative attitudes. Officials and employes alike have been imbued with that spirit. Never has there been more urgent need for true conservative leaders that their followers may be guided aright in their actions which directly concern their work and also in revealing the fallacies of additional government regulations, both suggested and pending. As officers and employes it is clearly the duty of all to study, discuss and interpret the true meaning of the many and various proposals of additional governmental regulation, so that our associates and employes may be guided correctly and aroused to the opportunity of expressing their opinions and urging their legislative representatives to oppose to the utmost all such legislation.

"The requirements of modern commerce have been such as to revolutionize maintenance of way methods completely during the past 20 years. Speed and economy have been two of the most important factors which have favored the introduction of many mechanical devices designed to accomplish better results and conserve materials by adding to their period of useful service. All of this has meant additional responsibilities and requirements for men in supervisory positions. The training of men requires additional care and expense so that now more than ever economic considerations point to a practical stabilization of forces as the adequate solution. While changes in methods have been gradual, nevertheless such changes have been so marked in the whole that roadmasters and supervisors have felt the need more than

ever before of additional enlightenment and education. The Roadmasters' Association has contributed much to this education. The gathering and meeting together for the free and easy discussions and interchange of ideas with regard to practical work has made your association indispensible."

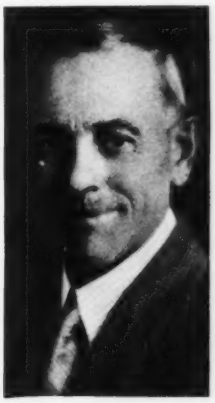
H. H. Talboys (Nordberg Manufacturing Company), president of the Track Supply Association, extended the greetings of that organization and referred to the contrast between the high-pressure sales methods that characterize selling to other industries with the methods prevalent in the railway industry. It is a pleasure to sell to the railways, he said, because railway selling is not high-pressure selling, by reason of the fact that so long an interval elapses from the time when a salesman calls on a railway man until that call matures into an order that any "pressure" cools off. The relationship between railway officers and those who sell to them, he said, is more pleasant than is generally found in other industries.

W. O. Frame
First Vice-President



A. H. Peterson
Second Vice-President

T. F. Donahoe
Secretary



C. A. Lichty
Assistant Secretary

E. E. Crowley
Treasurer

President Haley's Address

After reviewing the work of the association during the last year, President Haley stated that "the Roadmasters' Association occupies a field of its own. Its sole purpose is to promote better and more economical track maintenance. Its membership is comprised of practical men who face all the difficulties pertaining to the maintenance of track; they are the men on the ground. I know of nothing more beneficial for these men than the opportunity to meet and discuss the many problems that confront them and the privilege of looking over the latest appliances adapted to their work."

Mr. Haley then referred to the problems that are confronting the railways today. They are subjected, he said, to unfair competition in the air, on land and on water, and their competitors are subsidized by the public in many ways. Few people stop to think of the contributions which the railways make to the national welfare. They spend more money for materials, wages and taxes than any other industry. Without railway taxes many schools would be forced to close. The railways also provide the safest and most comfortable means of travel. They carried nearly 500,000,000 passengers in 1935 without a single fatality, while during that same year 37,000 people were killed on the highways. Yet the government maintains a bureau of safety to investigate accidents that occur on railways while the slaughter on the highways is a matter of little concern to the government.

The public does not realize, he continued, how much expense the railways incur to combat floods, storms and other disasters. They spare neither money nor effort in restoring their lines. Their men undergo untold hardship for long hours in order that their lines may be opened for the transportation of food, fuel and other necessities. What do we find on the highways? Did one ever hear of a highway transportation company spending large sums of money to open the highways to service? On the contrary, their procedure is to lay off their truck and bus drivers and wait for county and state forces to open up the highways at the expense of the taxpayers, while the people they serve are left to freeze or starve.

In concluding, Mr. Haley suggested several means in which the association might serve the railways.

(1) Continue to use every effort to promote better and more economical maintenance.

(2) Make the best possible use of the labor-saving machinery provided by the companies to secure the maximum return from the investment.

(3) Co-operate freely with other departments in all activities that pertain to the good of the service.

(4) Keep posted on matters in which the railways are widely concerned in order to be able to refute false propaganda and to keep the facts before the public.

Roadmasters' Association

Officers 1936-37

B. E. Haley, President, General Roadmaster, A.C.L., Lakeland, Fla.

W. O. Frame, First Vice-President, Assistant Superintendent, C. B. & Q., Wymore, Neb.

A. H. Peterson, Second Vice-President, Roadmaster, C. M. St. P. & P., Chicago.

T. F. Donahoe, Secretary, Supervisor of Road, B. & O., Pittsburgh, Pa.

C. A. Lichty, Assistant Secretary, Chicago.

E. E. Crowley, Treasurer, Roadmaster, D. & H., Oneonta, N. Y.

Executive Committee

Armstrong Chinn, Past President, Chief Engineer, Alton, Chicago.

(Terms Expire September, 1940)

R. L. Sims, District Engineer, Maintenance of Way, C. B. & Q., Galesburg, Ill.

E. P. Safford, Supervisor, N.Y.C., Silver Creek, N.Y.

(Terms Expire September, 1939)

R. H. Carter, Assistant General Yardmaster, Illinois Central, Chicago.

W. S. Lacher, Managing Editor, *Railway Engineering and Maintenance*, Chicago.

(Terms Expire September, 1938)

J. J. Clutz, Supervisor of Track, Penna., Trenton, N.J.

F. B. LaFleur, Roadmaster, Sou. Pac., Lafayette, La.

(Terms Expire September, 1937)

W. H. Sparks, General Inspector of Track, C. & O., Russell, Ky.

B. Esbenson, General Roadmaster, U.P., Milford, Utah.

(5) Redouble efforts to promote safety to employes, the public and the property of the road.

In conclusion, Mr. Haley stated that he was "unable to believe that the men who built our great railway systems to their present high standard of service cannot longer continue their existence. The brains that drove these lines from coast to coast can carry on until the railways are brought back to their rightful place.

The Trackman's Responsibility for the Safety of Highway Crossings

Report of Committee

E. J. Brown
Chairman

IN this era of speed, with highway vehicles competing with the railways, and with the ever-increasing number of highway grade crossing accidents, public opinion seems to turn to the railroads for a solution of the problem presented by these accidents.

The Number of Crossings

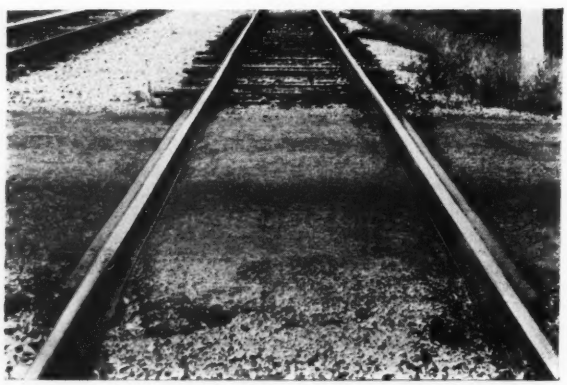
The Interstate Commerce Commission reports 234,000 grade crossings at the end of 1935. Great progress has been made in both the separation and the elimination of crossings since 1935, with the Federal Government participating in the expense. A large number of crossings have been relocated and others improved, both as to grade and mechanical warning devices. In 1935 funds were made available specifically for grade separation and improvement, and under this authorization a total of 854 grade crossings have been eliminated, 881 eliminations are under construction and 371 are programmed for construction, a total of 2,106. In addition 343 existing grade separations are being rebuilt, while 1,204 crossings have been protected with automatic warning devices.

When grade separation is considered, careful surveys should be made to insure that all angles are brought before those in authority in order that the most may be realized for the money expended; for illustration, it may be that one separation might make possible the elimination of two or more grade crossings. Further Federal funds have been appropriated for grade crossings eliminations for the fiscal years 1938 and 1939 but at the rate at which crossings have been eliminated during the last few years it would require 190 years to take out all grade crossings. The foregoing figure indicates that the grade crossing will be with us for a long time to come; many in rural districts will never warrant separation and it is with these and others which still exist that the trackman must contend and maintain in the best possible manner.

The demands on the railroads for higher speeds of both passenger and freight trains, coupled with the increased speeds of motor vehicles during the past few years, have increased materially the need for more refinements at highway crossings. Speeds of 90 to 100 miles an hour are not uncommon for passenger trains and speeds of 65 to 70 miles an hour are maintained for many freight trains. Automotive traffic likewise has increased its speed so that we have a potential hazard at a highway crossing, even when the crossing is maintained in the best possible condition. Likewise motor transportation on the highway has increased in tonnage as well as volume. Heavy trucks add to the wear and tear on crossings and increase their maintenance. With the prevalent willingness of the motorist to risk his life in a race for the crossing, the need for greater safety at highway crossings for both highway and railroad traffic is essential.

Our first consideration should be given to the safe passage of vehicles and pedestrians over the crossing. The public expects and demands smooth riding crossings and the railroads are severely criticized when their crossings are not in good condition and do not have a smooth riding surface. This applies not only to the crossings themselves but also to the approaches and to the intermediate spaces between tracks. Rough pavement requires the motorist to watch the roadway and distracts his attention from approaching trains. This condition is aggravated where two or more tracks are crossed and one track is lower than the other. A level crossing is essential and can be maintained more economically and with less complaint from highway outhorities.

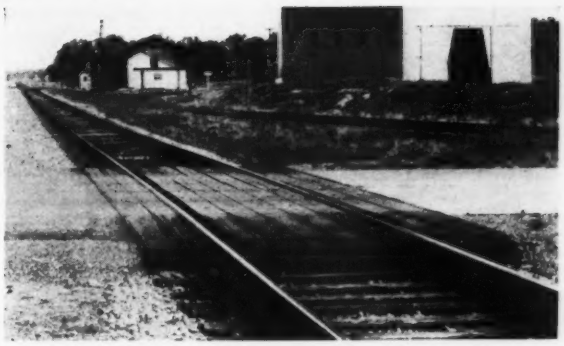
The fundamentals of a good grade crossing have been discussed by this Association a number of times but to touch briefly on them, these requisites are proper drainage, sufficient ballast section to insure a good surface, good ties and rails of such lengths that joints will be outside of the crossing. The materials used in the crossing construction itself vary from the box type with planks along the rail and ends of the crossing, filled with cinders, gravel or crushed rock; the full plank type; the rail crossing; the built-up type, using bituminous materials; the concrete crossing and the metal crossing. Each of these has a



Bituminous Crossings Present Smooth Surfaces

different method of maintenance and a different unit cost.

The supervisor must give consideration to the type of construction to be used, for all have their merits in the location for which they are best suited. After their installation a certain amount of maintenance is necessary and this is an important factor in the life of the crossing as a little work done when needed may save a major rehabilitation. Certain types of crossings, such as those of metallic and certain bituminous construction, become slippery during wet and freezing weather and this must be overcome by having cinders or sand at hand to correct this condition. Poor planking or planking that has become loose owing to spikes pulling through, or the poor condition of cross ties which have been badly cut through mechanical wear, allowing the rail to become loose, should be corrected. To overcome this difficulty double shoulder tie plates are recommended, with the spikes driven in anchor holes to secure the plates to the ties; they will not only hold the rail securely in place but will also help to maintain gage.



Creosoted Gum Wood for Crossings Is Meeting with Much Favor

The protection of the flangeways is one of the important features of any well constructed crossing, care being taken to have them of sufficient width but not so wide as to make them unsafe. Trackmen must make a careful inspection of these flangeways to see that they are free from obstructions, especially in rural districts where roads are dragged. The highway department should be asked to instruct its men to clean these flangeways after dragging roads and thus prevent derailments. During winter months ice and snow accumulate in flangeways and if the section foreman is not alert to clean it out a derailment is likely to occur. In reading Interstate Commerce Commission reports on train accidents one notes that quite a number of such derailments occur. We cannot, therefore, place too much stress on the importance of proper inspection.

The approaches to a highway crossing are as important as the crossing itself. With the rather general use of longer and heavier trucks and buses, the approaches to all grade crossings should, where practicable, be level for a distance sufficient to permit a truck or bus to stop on a grade on which it can start without too much effort on the part of the driver because, aside from the possibility of stalling a heavy vehicle on the track in gear-shifting operations, the driver may be tempted to approach the crossing at too high a rate of speed if the approach on either side is not fairly level. Rough approaches, of course, are not only distracting to the driver but often cause loss of control by reckless drivers, with a potential accident in the making. Steep approaches, especially those where parallel highways are close to the railroad and the roadbed is on a fill, causing motorists to make an abrupt turn, should be eliminated where possible and the crossing moved to a new location. Where approaches are on a descending grade and in a cut, sufficient of the shoulder should be removed to improve the view. In the winter months where approaches are on either an ascending or a descending grade, cinders or other material should be kept on hand to put on the roadway to prevent vehicles from slipping.

Approaches Should Have Easy Grades and Good Surface

The view at crossings is important; it is not given enough consideration. True, many crossings have been in service for a long period of years where the view is bad. This is true mostly in municipalities, where little can be done to correct the condition, but warning signs can be installed advising the motorist of the condition. In outlying territories vegetation should be kept cut, trees removed and any objects that might obstruct the view should be eliminated. The section foreman should be tactful and diplomatic in requesting adjacent property owners along the railroad to trim hedges and trees or consent to the railroad doing it, authority for which is, for the most part, readily given. Where authority cannot be obtained and conditions warrant, the local highway commissioner should be contacted to obtain the desired results.

Warning signs of various types and design are on the market, each having some merit; but consideration should be given to the particular sign and its meaning at certain crossings. The standardization of highway crossing signs should be kept in mind at all times for the benefit of the motorist traveling from one state to another to enable him readily to recognize his position in reference to

Keeping Crossings Clear of Ice and Snow Reduces Accidents

railroad crossings. Too many signs at a crossing are worse than the absence of them for the reason that most motorists will not stop to read the signs and if they did on a heavy traveled road they would be creating traffic jams. One sign, conspicuously displayed, well maintained and giving the number of main tracks to be crossed is sufficient.

Most of the important crossings have wigwag or flashing light signals which work with the track circuit. Some of these are located at outlying points where signal maintainers are not available at all times and special devices have been installed so that trackmen can make such inspection as will insure that the signals are working properly.

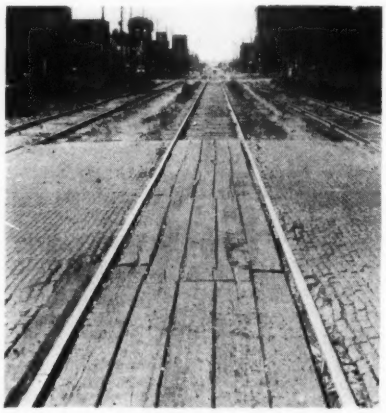
Gates and Flagmen

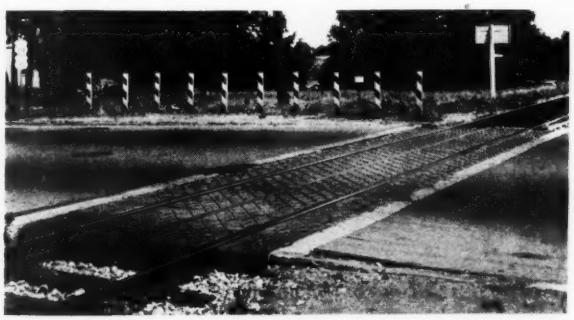
Although crossing gates are probably maintained by other departments, they should be inspected occasionally, particularly by the supervisor, to see that they are working properly and that the gate arm is painted often enough so it can be easily seen. Consideration should be given to the proper design of reflecting lights on the gate arms as the hazard of night driving is materially reduced by a barrier of warning lights across a traffic lane. Consideration should be given to the provision of as much illumination of crossings as is possible, especially in cities and towns; this one provision has done more to eliminate grade crossing accidents than can be calculated. It gives the motorist at night a view of the crossing, in addition to that provided by his own headlights and where gates are in operation they can be plainly seen.

On most railroads, the track supervisor is charged with the responsibility for the employment of crossing gatemen and watchmen. This is an important charge and one which takes a lot of time if it is handled in an efficient manner. Differing from the requirement of say ten years ago, when these jobs were considered places for old men or those who were incapacitated for other services, they now require fairly active men who are capable of getting out of the way of a machine which chooses to disregard their signal. Alertness is required also of men handling crossing gates to enable them to give sufficient warning to motorists before lowering the barrier and also getting the gates down sufficiently in advance of trains.

In order that flagmen be made aware of the responsibility of their duties, it is customary to furnish rules which are usually posted in gate towers and to require them to pass an examination on these rules. Frequent checks should be made by the supervisor of the observance of these rules, as well as the alertness of the men in the performance of their duties.

Vigilance by the trackman in his inspection is important as he sees the crossings on his territory more frequently than anyone else on the railroad. He also understands local conditions from the standpoints of both highway and railroad traffic and, in maintaining his track through the crossing, he must naturally take care of the crossing itself. When approaching highway crossings on a motor car, he must be prepared to stop and must stop before crossing busy highways. Motor cars, rubble cars or trailers should not be set off on highway crossings as they detract the attention of motorists from approaching trains.





Above — Untreated Plank Crossings Are Difficult to Maintain in First-Class Condition. Right — Metal Crossings Are Used Widely

Conclusions

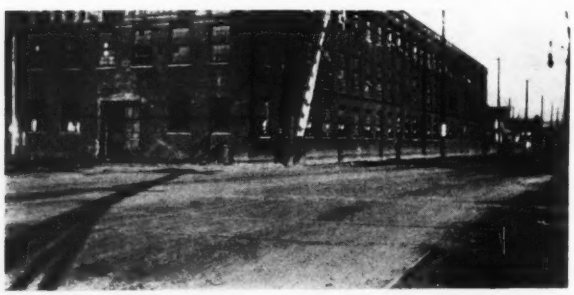
The conclusions of the committee are as follows:

(1) The safe crossing is one that rides smoothly and is of sufficient width for the traveled roadway and additional shoulders. Anything that can be done to help motorists cross the track and get into the clear is important.

(2) The best crossing is one which intersects the railroad at right angles and is composed of materials which are adequate for traffic conditions, well drained to prevent settling in open seasons and heaving in winter months and with view unobstructed.

(3) Realizing that any crossing is a potential hazard, sufficient warning signs of proper design, well maintained and located, are essential.

Committee—E. J. Brown (chairman), rdm, C.B. & Q., Chicago; F. J. Meyer (vice-chairman), asst. engr., N.Y.O. & W., Middletown, N.Y.; F. C. Chandler, rdm., A.C.L., Tampa, Fla.; F. L. Etchison, rdm., A.C.L., Charleston, S.C.; A. F. Kadow, asst. engr. B. & O.C.T., Chicago; F. J. Liston, rdm., C.P.R., Montreal, Que.; F. H. Masters, asst. ch. engr., E.J. & E., Joliet, Ill.; R. E. Meyer, rdm., C. & N.W., Wall Lake, Iowa; J. W. Morgan, supvr., C. of Ga., Leeds, Ala.; G. P. Palmer, engr. maint., B. & O.C.T., Chicago; S. W. Payson, rdm., St.L.S.W., Enid, Okla.; N. E. Peterson, rdm., C. & I.M., Springfield, Ill.; A. L. Pollock, rdm., A.T. & S.F., Oceanside, Cal.; F. W. Tomlinson, asst. supvr., Penna., Trenton, N.J.



An Obstructed View Always Creates a Crossing Hazard

Discussion

Opening the discussion, President Haley spoke of the grade crossing problem in Florida, with its large influx of visitors during the winter months, and said that, in his opinion, education of the public was one of the most important factors in improving the accident record at grade crossings.

O. Surprenant (D. & H. raised a question concerning the relative advantages of group meetings of crossing watchmen and personal contact with the men individually in the field, in promoting safety at crossings. Chairman Brown expressed the opinion that better results could be obtained if roadmasters and supervisors would discuss safety with each watchman individually, giving particular attention to the conditions prevailing at the crossing involved in each case. Mr. Surprenant felt that safety meetings of watchmen were more effective, especially when combined with contact in the field. He said that where discussion with watchmen individually was relied upon, it was often neglected because of other matters.

J. P. Corcoran (Alton) advocated the use of track circuit annunciators at crossings to give watchmen advance warning of approaching trains. Chairman Brown agreed that advance warning devices had merit at certain types of crossings, but pointed out the danger involved in possible failure of these devices, and the added responsibility which they put upon the roadmaster or supervisor.

Upon a question raised by W. O. Frame (C.B. & Q.) concerning the jurisdiction over crossing watchmen, it developed that while a few roads have watchmen supervisors in charge of all watchmen, the general practice is to give the roadmaster or supervisor jurisdiction over all crossing watchmen on his territory.

Both Chairman Brown and L. M. Denney (C.C.C. & St. L.) told of experiences at crossings of concrete highways where longitudinal expansion of the concrete slabs had caused crowding of the track, throwing it out of line. They said that where concrete roadways cross tracks, the roadmaster should always see that adequate provision is made for expansion of the concrete without encroaching upon the track.

Closing the discussion, Mr. Surprenant spoke of the advisability of arranging for additional watchmen or policemen at crossings during periods of exceptionally heavy use, such as often occur in small towns when carnivals or other local celebrations are held in the vicinity of the railroad.

The Curing of Soft Roadbed

By A. A. MILLER

Engineer Maintenance of Way, Missouri Pacific, St. Louis, Mo.

MOST railroads have soft spots in their roadbeds, where it is necessary to apply an extraordinary amount of labor and material—generally ballast—to maintain the track in even fair line and surface. They presented a problem, and every roadmaster who has to contend with them has prayerfully wished that he could get rid of all of them for all time. The condition to be overcome may be confined to an individual location where the soft roadbed extends for a considerable distance, it may consist of many short "soft spots," or it may include both. These soft places occur both in cuts and on fills, but wherever they are they are still soft spots to the trackman.

During my 35 years experience in maintenance of way, the most common methods employed by the railroads generally to correct such conditions have involved the use of drain tile in cuts and cross drains of several different types in embankments. Much of this work has produced good results but there has generally been some difficulty, particularly in cuts, in determining definitely the depths of the water pockets. Moreover, there is usually some quesion as to whether the installation will positively cope with the conditions so that the work will not have to be done over in the future because of the reappearance of the soft spot. These methods involve more or less disturbance of the roadbed so that in many cases it is quite a long time before the roadbed has settled or stabilized sufficiently to permit the raising of slow orders. Furthermore, while this seasoning or settlement is taking place, a considerabe number of man-hours are as a rule spent in picking up low places, with the result that the expense involved in taking care of the situation during the "seasoning" period is rather heavy in some instances.

A. A. Miller

Low Cost Methods

On a railroad where there are many such soft places or water pockets, where the requirements for ever-increasing speeds have to be met effectively, and where dependability of service is the keystone in the arch of economic results, it is natural that quick, low-cost, effective methods of eliminating these roadbed liabilities should be sought. I shall therefore describe some of the methods that are being employed on the Missouri Pacific Lines to correct soft places in the roadbed.

The drawings show rather clearly what is involved in the several methods. Figure 1 presents a typical view of what is involved in driving cull ties or other cheap sticks of timber in a water pocket in a cut. Ordinarily a stick of timber eight feet long is of sufficient length to extend through the water pocket and penetrate from two to three feet into the more solid material beneath. It is not necessary to drive the cull ties as a solid wall, but they may be spaced approximately the same distance apart as the ties in the track. The ties should be driven as close to the ends of the track ties as possible, and so that the level of their tops is about at subgrade, or at the bottom of the ballast bed. It is particularly desirable to keep the tops of the driven ties out of the ballast shoulder so that the shoulder will be free of any obstruction that might interfere with the operation of such roadway machinery as ballast discers and cleaners.

It is essential to extend the lines of driven ties about thirty feet beyond the ends of the water pocket to insure complete confinement or "tucking in" of the pocket. Any kind of timber may be used which is of sufficient strength to withstand the driv-

ing; pine, oak, gum, etc., have all been used with good success. The cheapest available sticks that are sufficiently strong will prove satisfactory.

In some places it has been found that the material below the water pocket is so hard or resistant that ties break under the hammer blows when an attempt is made to drive them into it. Such situations can be overcome by driving light rails in 8 to 10-ft. lengths into and through the pocket at intervals of about 10 ft., and placing against these rails a wall of 3-in. by 10-in. planks extending from the bottom of the pocket to subgrade. Almost any kind of fastening may be used that will hold the planks to the rails. This provides a submerged or underground timber wall that is held in position by the light rail posts driven to a toe-hold depth in the material below the water pocket.

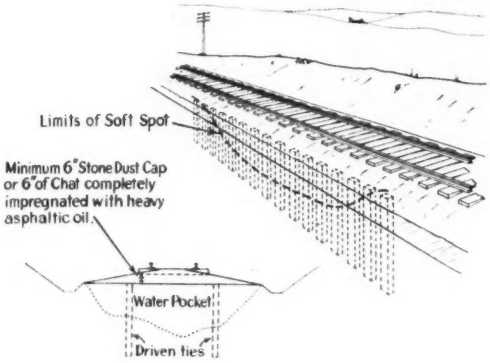

Limits of Soft Spot
Minimum 6" Stone Dust Cap or 6" of Chat completely impregnated with heavy asphaltic oil
Water Pocket
Driven ties

Fig. 1 (Left) Ties Driven to Stabilize Soft Spots

This method of driving cull ties or short timbers may be used successfully on fills up to three and four feet in height. On light fills, however, it is advisable to use timbers of the same cross-section as ties ranging in length from 8 to 12 ft., depending upon the local situation.

Has Proved Successful

After the ties are driven in cuts, it is sometimes desirable, but not absolutely necessary, to cap the ballast with a binding material which sheds water readily, such as limestone screenings or chats, and in some instances it is found desireable to impregnate this capping material with an asphaltic oil. It has been our experience that the driving of ties in soft roadbed has the effect immediately of removing the trouble by so stabilizing the roadbed that no more extraordinary applications of labor and material are required.

During the last six years the Missouri Pacific has driven 928,000 cull ties in wet cuts and on low fills, and has effectively eliminated 132 track miles of "soft spots." As the driving is done on both sides of the track, this means that approximately 7,040 cull ties were used per mile. In a few cases, on the low sides of curves in cuts, driving on only one side is effective, but such cases are rare.

The first experiment of this kind on the Missouri Pacific was made in 1928 in a cut on the main line in Oklahoma. It was a particularly bad spot, but the results were immediate. Beginning with that experiment we have progressively removed many of these liabilities by the tie-driving method.

The cost of doing this kind of work will vary on different railroads and on different parts of the same railroad. The cost of the cull ties is a variable, ranging in the last few years from as low as 12 cents to as high as 20 cents each. The labor cost for driving also varies, as it depends to some extent on the density of the driving; in some places great numbers of ties are required in short distances, and in other places fewer ties may be made to extend greater distances. However, a fair idea of the costs can be obtained by considering the figures covering the driving of the 928,000 ties referred to previously. Exclusive of transportation charges, these ties cost an average of 54.3 cents in place, divided as follows: Labor, $0.346; material, $0.186; and rental of equipment, $0.011. With the exception of 68,000 ties, which were driven by our own forces, all of our cull ties have been driven under contracts.

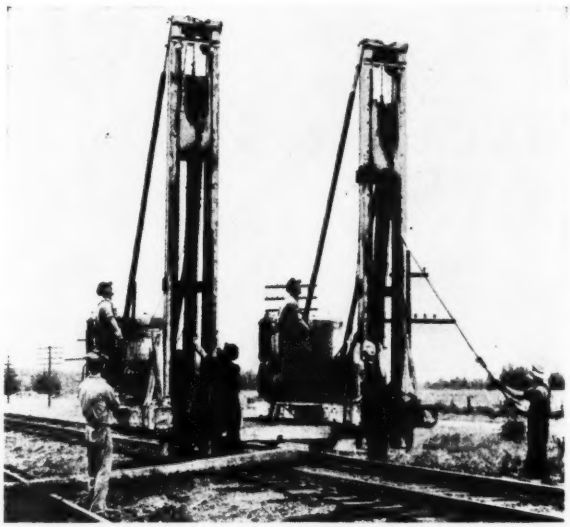


Fig. 2 Equipment Used for Driving Piles on Both Sides of the Track at Once

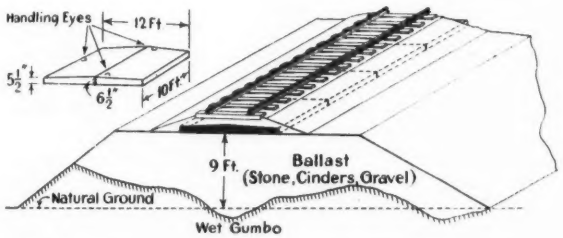


Fig. 3 Concrete Sub-Ballast Slab

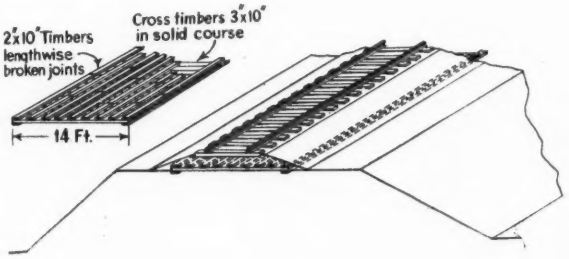


Fig. 4 Timber Sub-Ballast Slab

One of the types of machines used by the contractors is shown in Fig. 2. The machines are not all alike, but they are all built for rapid driving of the ties and for clearing the track quickly to permit the passage of trains. The type shown permits of the driving of two ties or piles—one on each side of the track—at the same time. Other types, of the same general design, drive on only one side at a time. An article in the June, 1936, issue of *Railway Engineering and Maintenance* describes this method of driving cull ties in wet cuts.

Other Methods

The drawings in Figs. 3, 4, 5, 6, and 7 illustrate several other methods that have been used to correct soft places or water pockets in fills or embankments. Where the condition to be overcome extends for a considerable distance and is the result of the presence of unstable material in the fill, rather than a true water pocket, I favor the methods shown in Figs. 3 and 4. These two methods are also more applicable where the height of the fill is greater than 25 ft. On fills higher than 25 ft., the methods shown in Figs. 5, 6, and 7 usually involve greater costs.

These latter methods are used where the height of the embankment is 10 ft. or more, but generally not more than 25 ft., and where it is necessary to bind or fasten the piling or sticks together to insure that individual pieces do not start moving outward, possibly thereby starting a displacement in the embankment that will result in failure, or at least rendering the results less effective. I think that the failure of these methods to give the lasting results in the past has been due to the fact that the piles were not fastened together by some such method, and further that they were not driven deep enough into the original ground. To obtain the desired results the depth of penetration into the original ground on fills more than 8 ft. high should never be less than 10 ft. On fills less than 10 ft. high it is not necessary to fasten the piling or poles together but sufficient penetration into the original ground should be assured by providing sticks of adequate length.

All of these methods have been tried and have been found to be effective. Knowing this, it becomes a comparatively easy matter for one to determine costs, based upon the availability of material, the location, the transportation involved, the condition to be corrected, etc., for the purpose of selecting the method that fits the situation most economically.

During the last eight years, the Missouri Pacific has driven about 100,000 piles in accordance with the methods illustrated and has stabilized 50 miles of embankment.

Whether cull ties or timber of that size, or sticks of timber the size of piling, are to be used, depends on the depth of the "soft spot" conditions. At some places where there is neither cut nor fill, the track lying almost at the original ground line, water pockets have ranged up to 10 ft. in depth, thereby requiring the driving of poles 18 and 20 ft. long. At other places, where fills ranged from 4 to 8 ft. high, the water pockets reached to depths of as much as 8 ft. in the original ground and it was necessary to drive poles from 16 to 25 ft. long. In such places the spacing of the poles is usualy 3 or 4 ft. and it is not necessary to bind may be of any kind of timber, and or fasten them together. These poles may be of any kind of timber, and the only requirement really necessary is that they be straight. It is not necessary to bark or season them—simply cut them to length and trim off the branches and they are ready for driving.

The concrete slab method, shown in Fig. 3, was tested first about 2½ years ago on a stretch of track 110 ft. in length where the height of the fill was only 3 ft. but the depth of the pocket was more than 15 ft. below the track. The roadbed was very unstable, and the results obtained by this installation were such as to justify a test on a more extensive scale. Consequently, last November an installation was made on 2,600 ft. of track on a 9-ft. fill, where the unsatisfactory condition of the roadbed was caused by the presence of a very unstable material in the fill rather than by a true water pocket. The results of this installation have been highly satisfactory.

To extend the scope of this experiment, which is based on the premise that a slab under the track results in a uniform distribution of the load, and to determine whether a more or less flexible floor, as compared to the concrete slabs, would be effective, an installation such as shown in Fig. 4 was made some six months ago on a fill about 30 ft. high and 1,400 ft. long. This fill is unstable and apparently has never become seasoned since it was constructed. So far as

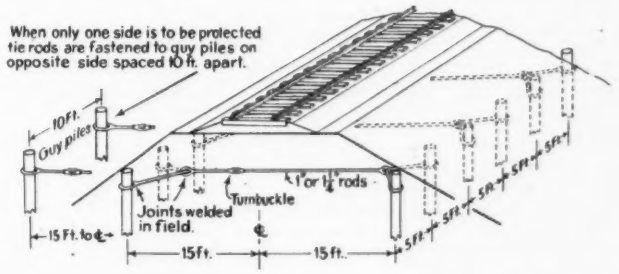


Fig. 5 Piling Bound With Tie Rods

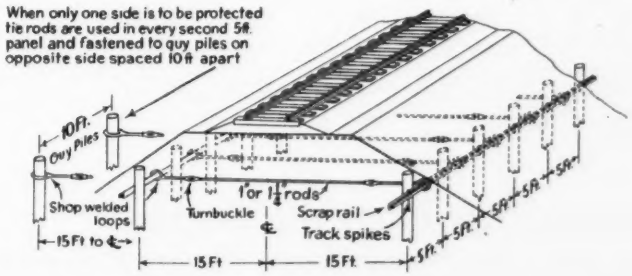

When only one side is to be protected tie rods are used in every second 5ft. panel and fastened to guy piles on opposite side spaced 10 ft apart
10Ft.
Guy Piles
Shop welded loops
Turnbuckle
1" or 1¼" rods
Scrap rail
Track spikes
15 Ft to ℄
15 Ft
15 Ft
5 Ft.
5 Ft.
5 Ft.

Fig. 6 Piling Bound With Scrap Rails and Tie Rods

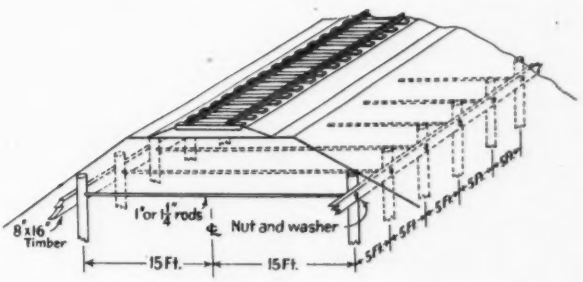


Fig. 7 Piling Bound With Timbers and Tie Rods

we can determine there has always been a slow order on the track on this fill. Immediately after the installation was made the slow order was lifted and normal speed has been permitted over the track. Untreated timber was used in this installation as we did not know just what results we would obtain, but knowing now that this method is effective, we believe that treated timber should be used in carrying out this plan elsewhere.

Costs Vary

I have not attempted to set up any detailed cost figures covering the methods shown, as the variations in rates of pay, transportation costs, rental of equipment, etc., give wide ranges in costs for different railroads and on different sections on the same railroad. To give at least some idea of the cost, this class of work has cost the Missouri Pacific as little as $3.65 per track-foot and as much as $6.

The question has been raised as to whether failures may occur as a result of the ties or piling decaying to such an extent as to lose their resistance to the pressure of the roadbed materials against them. If the job is properly done, all of the materials installed will be sealed in the roadbed so that they will not be exposed to the air; therefore, I think that they will last many years.

Discussion

In answer to a question from Armstrong Chinn (Alton) concerning the permanence of the results obtained by driving ties, Mr. Miller expressed his confidence in permanent results even after the ties had decayed, but said that in event of failure in individual cases, it may be necessary to drive another row of ties outside the original row. In some instances the driving of the ties causes them to puncture impervious strata and thus afford a means of permanent drainage.

Answering a further question, he said that the concrete slab and wood blanket installations cost $5 and $4 per track foot, respectively, but that the cost in individual cases would vary with local conditions. Treated wood, he added, would obviously cost more than the untreated wood that was employed in the case cited in the report.

W. O. Frame (C.B. & Q.) reported that the service life of driven ties and piles on his road ranged from 6 years to more than 10 years and that the stabilizing effect disappeared after the timber decayed. He added that these installations had all been of an emergency character and that his road had almost always used tile or pipe in cuts. Mr. Miller replied that he had found that driven ties were effective for as many years as drain tile and were much less expensive. To cure a water pocket 60 ft. long in the middle of a 1,000-ft. cut with ties requires work only in the vicinity of the trouble, he explained, but if tile is used, it requires a pipe line 500 ft. long. In general, he added, the cost of driven ties is only one-third the cost of drainage so that even if the former lasts only six years, it is still cheaper.

J. Morgan (C. of Ga.) said he had used ties to cure water pockets since 1913 and had had no failures. J. O. Surprenant (D. & H.) stated that he installed about 4,000 ft. of drain pipe each year and contended that on his road tie driving would result in too much interference with traffic.

Relationship Between the Stores and Maintenance of Way Departments

By W. S. MOREHEAD,
General Storekeeper, Illinois Central, Chicago

THE supply department is essentially one of service to other departments which are users of material. Inasmuch as the maintenance of way department uses approximately 50 per cent of all material purchased for use on railroads, outside of locomotive fuel, the relationship between the supply department and the maintenance of way department should be about the same as that between a merchant and his largest customer. However, the storekeeper must not lose sight of the fact that his job must be done without tying up unnecessary money in material and supplies stock, or the spending of unnecessary money in the unloading, storing or shipping of such material.

It is estimated that it costs railroads 15 per cent to carry material stocks. This figure is made up of interest on the investment, extra handling costs, obsolescence and deterioration. You will see, therefore, that the 100 per cent service your storekeeper may give you by having what you want, when you want it and where you want it, may be accomplished at an extra expense to the railroad that cannot be justified if all factors are taken into consideration.

W. S. Morehead

The furnishing of maintenance of way materials comes under three groups, namely, program material, special A.F.E. material, and standard material for current use. In supplying this material, we have found the following system of planning and ordering to be the most efficient:

Program Material

Program material embraces new rail, crossties, switch ties, tie plates, rail anchors and rail fastenings for use with new rail, as well as treated bridge lumber. These materials are ordered on estimates furnished by the engineering department, and purchases are so made as to take advantage of quantity price. Purchase orders usually specify "to be delivered as called for." As a result, deliveries can be made in carload lots direct to point of use and thus avoid duplicate handling. In the event that ties and lumber become seasoned and it is necessary to treat them in advance of the time actually required for use, these materials are stored on treating plant yards until required and then shipped direct to the job.

Requisitions for the materials of the second class are prepared from estimates of the engineers, divided as between stock items and special items.

Those for special items are passed to the purchasing agent for purchase, and those for stock items to the storekeeper serving the territory on which the work is to be done. Material required in carload lots is ordered for direct shipment to the job; that required in less than carload lots is ordered shipped to the nearest store to be assembled with other stock material and shipped out as required.

It Costs Railroads 15 Per Cent to Carry Material Stocks

The stock of standard materials for current use is maintained by the supply department. Orders for the replenishment of such stocks are based on past consumption as reflected by stock books maintained on these items, plus any knowledge the storekeeper can gather from personal contact with roadmasters, supervisors and foremen concerning the requirements of contemplated work.

Should Attend Meetings

The storekeeper should welcome every opportunity to attend division meetings in person or have his stockkeeper who is assigned to maintenance of way materials attend such meetings. In addition, the storekeeper or his assigned stockkeeper should confer at length with roadmasters, supervisors and foremen as to work in progress or anticipated. With knowledge thus obtained, coupled with the material performance as reflected by his stock books, the storekeeper should be in position to order, redistribute or offer substitute materials to the best advantage. His records should be so maintained as to reflect readily the material on hand, and its location, as well as the amounts due on purchase orders and the amounts due the division on any unfilled orders which he may have on hand.

I hesitate to use this word "substitute" lest at the close of my remarks this become a club which some of you, who have been sinned against by having improper substitutions made, may use to usher me from the platform. I hasten to admit that I have many times been guilty of making substitutions. Substitutions, at times, are no doubt wrongly made, but if made properly after a prior understanding with the officer who ordered the material, it may be possible to utilize obsolete or semi-obsolete material which otherwise might become almost a complete loss to the railroad, and prevent a further outlay of cash in the purchase of additional material.

Obsolete Material

One of the hardest problems for the storekeeper is to dispose of obsolete and semi-obsolete material at the smallest possible loss to the railroad, and it behooves him to keep constantly on the alert to work off such items. We endeavor to keep a list of such items constantly before us and before the heads of departments using that particular class of material; hence the oft repeated query, "Can't we substitute?" You may ask: "Why have obsolete and semi-obsolete material on hand?" This is due to several contributing reasons, the chief of which are changes in plans, deferred work, errors in estimates, changes in standards, changes in machine models, and the retiring of equipment from service.

In order to avoid purchasing material for use on one division when there may be a surplus of like material on another division, a record of such surplus material should be maintained in the general storekeeper's office, and this surplus transferred, rather than to pass a requisition to the purchasing agent for an additional purchase. This information can be supplied by having all storekeepers report surplus materials on hand at regular intervals. If such surplus reports are to be of any value, storekeepers originating them should contact the roadmasters or supervisors and come to an agreement on just what is surplus.

Pricing of Material

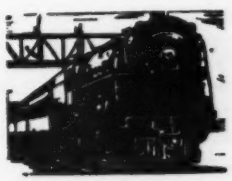
Inasmuch as it is the practice on many roads for roadmasters and supervisors to work on a monthly allowance, the storekeeper can render a real service in keeping the users of material informed as to the cost of the various items used. On our road we have adopted the practice of stenciling the price directly on larger items of material shipped to the line of road; also our shipping notices, which accompany material shipments, carry the price of each item included in the shipment.

Scrap credit is an important factor in exercising control of material expenditures. We therefore allow scrap credit on the larger items of scrap in the same month the new material is applied. We encourage prompt shipment of miscellaneous scrap items, and credit is allowed for these immediately upon receipt at the receiving store.

When no special machinery is required and it is not necessary to stock new repair parts, our practice is to reclaim locally as many items of roadway material as is considered practicable. Reclaimable items requiring special machinery and the addition of new repair parts are sent to a central plant for reclamation. Such reclaimed items are shipped out on orders to the extent of the supply available before new items are furnished.

Personal Contact

In closing, I would like to stress further the importance of personal contact between the storekeeper and the roadmaster and supervisor, with reference to the material requirements for work in progress or anticipated. Avoid letter writing where it is at all possible to get together in person or by telephone. By so doing, a closer and clearer understanding can be had between the parties and the railroad's interests best served.



Good Practice in the Laying of Rail to Secure Workmanlike Results

Report of Committee

THE term railroad is exactly what the name implies, for with the introduction of rail the road became a railroad. In handling rail a considerable saving in cash outlay may be realized if the roadmaster, upon receiving his allotment of new rail, personally sees to it that the rail is installed in the track in such a manner as will assure its giving maximum service with minimum maintenance expense.

When a shipment of new rail is received, the roadmaster should carefully sort it as to carbon content and classification and distribute it for installation in the track accordingly.

The usual rules of distribution are as follows:

No. 1 rails, unpainted—To be used on tangents and light curves.

No. 1 rails, painted blue—To be used on sharp curves and tracks carrying the heaviest tonnage.

No. 1 "A" rails, painted yellow—To be used on tangents and light curves. Most roadmasters find that segregation is more apt to take place in yellow-end rails, thus making it advisable that these be laid out of face and their location carefully marked so that they may be given more than ordinary inspection from time to time in order that pipes and split heads may be detected as soon as physical conditions denote their development.

No. 1 short rails, painted green—To be used around switches and crossings to avoid cutting full length rails, and on the low side of curves to stagger the joints properly. When short rails are received in quantities greater than required to take care of the above conditions, they should be laid on tangents, care being used to see that rails of the same length are laid opposite each other.

No. 2 rails, painted white—To be used on such tracks as are designated by the chief engineer maintenance.

"X" rails, painted brown—Consider as No. 2 rails and use on tracks designated by the chief engineer maintenance. These rails have the letter "X" stamped on both end faces.

In unloading rail, the roadmaster should see to it that a sufficient number of first class short rails are unloaded on the inside of curves so that proper joint stagger may be provided. The difference in length of the inside and outside rails may be readily computed in advance by bearing in mind that the low rail gains one inch on the high rail for each degree of central angle. The central angle of any curve should be readily obtainable from the track chart.

L. E. Thornton
Chairman

Too much importance can not be attached to the proper sorting of rails according to mill classification and the mill loading records should be studied carefully before a car is billed to its unloading destination. When unloading rail, care must be taken to prevent kinking or injury of any kind. To secure best results, any type of mechanical unloader is satisfactory which will remove the rail from the car in a fast, economical and workmanlike manner, and lay, *not drop*, it alongside of and convenient to the track to be relaid. Dropping or rough handling of rail in any way may set up internal strains which may form the nucleus for the future development of an internal transverse fissure.

Laying the Rail

Now that we have the rail sorted and unloaded let us look to its installation in track:

After the removal of the old rail, which may be done in any approved manner suitable to the roadmaster, the tie plugs should be driven to the full depth of the old spike holes and the adzing machine started. The best men available should be placed on these machines and they must exercise care to see that the machines are at all times cutting a level surface; otherwise, the rail will not be properly canted, with the result that the rail will not show a good "face" under traffic and will probably have beads formed along the edges due to the head metal flowing under the uneven wheel bearings. The position of the cutting heads of the adzing machines should be adjusted each time the relay changes sides and periodical checks should be made during the day to be sure that the cutting head is operating on a level plane. After the adzing has been completed, creosote oil should be applied to the newly adzed surfaces of all ties that are to remain in the track so that any untreated wood surfaces, which may be exposed by the adzing, will be properly protected.

Tie plates should be placed ahead of the machine setting in the rail and the rails should be laid one at a time and the ends brought together against expansion shims of proper thickness. Before applying the angle bars, all rail ends should be inspected to see that they are free from grit and dirt and if they are not they should be cleaned with a stiff wire brush. It is also very beneficial to oil the rail ends before applying the angle bars as this will provide freer slippage of the rail when expanding and contracting and thus prevent frozen joints. It will also help the angle bars to seat themselves better.

When placing the bars they should be full bolted as quickly as possible after the rail is set in, using a mechanical bolt tightener, if one is available. If the tightening is done by man power, track wrenches of equal length should be used, and insofar as possible, men used on the wrenches should be of approximately the same strength so that all joint bolts will be tightened approximately to the same tension.

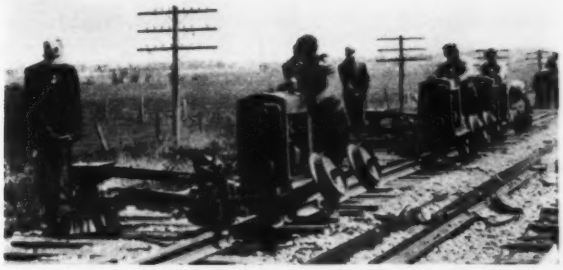
It has been the practice in the past for trackmen to turn up the nuts on angle bar bolts so that the nuts all set squarely in the same horizontal plane. To attain this condition it is oftimes necessary to slack off nuts. The Committee recommends that this be discontinued. Better results will be obtained by attaining uniformity of tension rather than uniformity of position of the bolt nuts.

The rail should be seated in all of the tie plates for its full length before any spiking is done. All of the plates must be applied so that the shoulders fit squarely against the base of the

rail and are centered properly on the ties. Care must be exercised by the foreman to see that the cant of the plates is in the right direction; otherwise, the purpose of the cant will be entirely lost and might even result in the breaking of the rail, due to the rail having only a line bearing along one edge of the base on plates that are turned in the wrong direction. It will not take long for an observing man to get the proper feel of a tie plate if he bears in mind that the outside shoulder is usually 5/8 in. to 3/4 in. longer than the inside shoulder, and also that the date stamp and weight markings are always on the outside.

The rail should be fully spiked at the end of each day's work and, if possible, it should be full spiked before letting a train run over it, in order to insure the proper setting of the tie plates. Along with spiking, of course, comes gaging. In spiking the first line of new rail laid, care should be taken to see that the gaging is done near the quarters of the old rail and that no gage spiking is done opposite the old joints. Insofar as possible, the new rail should be kept in good line and more or less independent of the old rail, checking the gage from time to time to see that it is never more than 3/4 in. wide or more than 1/4 in. tight. If the ties have been adzed properly, the distances between the gage faces of the old and new rail will seldom fall outside of these limitations. In cases where the gage distance does fall outside of these limitations, the old rail should be spike-lined at the points involved, to a rough conformity. This will be quite safe for the slow operating speed that will be effect until the old rail is replaced.

The new rail should be laid to standard gage on tangents and on curves up to five degrees. For curves between five degrees and ten degrees, the gage should be one quarter inch wide. For curves sharper than ten degrees, the gage should be one-half inch wide.



Good Adzing Insures a Level Bearing for Tie Plate and Rail

The spikers must use care to keep from striking the rail and must never spike over the rail unless it is absolutely necessary. Nicks caused by striking the head of the rail with a maul have been known to result in rail failures. A rail should never be brought to gage by striking the web with a maul. The rail should always be lined with a lining bar.

A responsible man must accompany the spikers with a gage; he should gage every fourth tie, and never a longer span than six ties. Exact gage is the result of frequent and careful inspection. Spikes should be driven straight and the gage must not be made tight; on the contrary it should be allowed to ride free as the general tendency is for gage to tighten up under traffic.

Double Spiking

All rail of 100 lb. or lighter section, on curves of three degrees or sharper, in high speed, heavy traffic territory, should be double spiked. Regardless of rail weight, curves sharper than five degrees should be double spiked.

In a preceding paragraph, mention was made of expansion shims. The tables used to determine the proper thickness of expansion shims vary with different railroads. Some roads conform to the A. R. E. A. specifications while others provide tables of their own. However, most roads use no expansion shims where the rail temperature is 100 deg. or over.

A rule which we believe will give good practical results is to lay rail close without bumping at rail temperatures of 100 deg. or over. For temperature less than 100 deg. allow 1/16 in. expansion for each 20-deg. drop in temperature. Only in extreme cases should rail be laid where the temperature is below zero.

Temperature readings should be taken by means of a track thermometer with the bulb placed against the rail and the thermometer allowed to remain in this position until it is known positively that the mercury has reached its peak. When the foreman is sure that the thermometer reading is correct, he may then apply expansion shims in accordance with the temperature table currently in use. Thermometer readings must be taken in accordance with weather conditions; six to eight readings per working day should be sufficient for most conditions.

No trains should be permitted to run over new rail until a sufficient number of rail anchors have been applied to reduce creepage to the absolute minimum. Anchors must be kept tight and in the event that a new design is received, the roadmaster must see that the foreman is given careful instructions in their proper application and maintenance.

Rail creepage is a variable quantity but to a great extent depends on the direction, density and speed of traffic. Creepage must be studied carefully and a sufficient number of anchors applied to combat each individual case, being careful that both rails are anchored to the same tie to prevent them from sluing. After angle bars have been full-bolted, ties full-spiked and proper anchorage applied, expansion shims must be removed.

After the new rail has been laid it should immediately be surfaced out of face. If possible, the surfacing gang should never be more than 24 hours behind the steel gang; otherwise, the new rail will have a tendency to seat itself in the old bed, with the result that, because of the uneven bearing

It Is Important That Gaging Be Done Carefully

Barring the Rail Out by Hand Is Economical and It Can Be Done Quickly Without Interfering with Other Operations

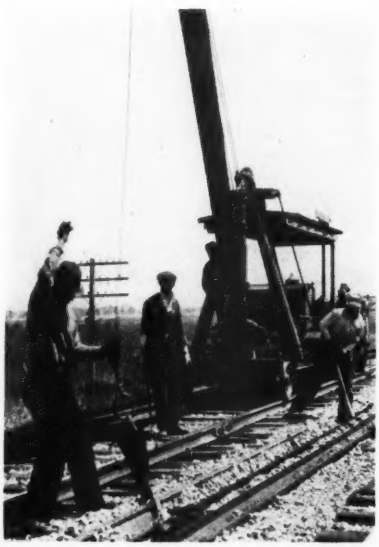
and surface line, kinks may develop.

Before the close of each day's work all swinging ties should be tamped firmly up against the new rail. In case of frozen ballast, shims may be used but these must be removed as soon as weather conditions permit.

When rail laying is completed for the day, a suitable temporary connection should be made to the old rail by means of a taper rail or compromise joint, using a short piece of new rail against the last full length new rail to avoid end batter on the new rail. In making the connection, no section of rail less than ten feet long should be used on either the old or new rail.

When the rail laying is completed, the permanent run-off should be made by tamping and the rate of run-off should be governed by the speed, in miles per hour, usually run over the section of track being laid. The rate of run-off should be one inch in a number of feet equal to the speed in miles per hour. It has been found that compromise joints make the best permanent connections and they should be placed opposite each other or staggered for a distance of at least 300 ft. If the rail is being replaced in kind, the above of course, does not apply.

An entirely new field is being opened up in rail laying by the use of rail welded into continuous stretches of a mile to a mile and a-half in length, breaking the rail only at insulated joints and switches. Owing to lack of experience with this type of installation, the Committee does not feel qualified to discuss the merits of continuous rail at this time; however, it is quite certain that the use of this type of construction will revolutionize rail laying and maintenance of track.



A Crane Is a Modern Necessity in the Rail Laying Operation

Summary

Summarizing, we find that the following will give very satisfactory results in the laying of rail:

1. Sort rail properly as to classification and carbon content and distribute accordingly.
2. Unload rail properly and under no circumstances drop it while unloading.
3. Maintain proper stagger of joints.
4. Adze all ties deep enough to remove all decayed wood so that the adzed surface is level and wide enough to seat the tie plates fully.
5. Apply anti-creepers at the time the rail is being laid.
6. Check rail temperature carefully and use expansion shims accordingly.
7. See that the rail is full bolted and spiked at the end of each day's work.
8. Watch the gage carefully and see that standard gage is maintained.
9. Surface track immediately after the rail is laid.
10. Provide proper permanent connections and run-offs after job has been completed.

We feel it is good practice to stress quality of workmanship rather than mileage of work turned out per day. Rail that is properly laid in accordance with the factors enumerated above will last better and be more economical in the long run.

Committee—L. E. Thornton (chairman), assistant engineer, Alton, Bloomington, Ill.; J. J. Clutz (vice-chairman), supervisor, Penna., Trenton, N.J.; F. G. Campbell, special engineer, E. J. & E., Joliet, Ill.; P. Chicoine, roadmaster, C. P. R., Vaudreuil, Que.; E. L. Farmer, roadmaster, St. L. S. W., Lewisville, Ark.; Wm. Hogan, supervisor, B. & O. C. T., Chicago; P. Immroth, roadmaster, A. T. & S. F., Syracuse, Kan.; C. J. Jaeschke, division engineer, M. P., Poplar Bluff, Mo.; P. L. Koehler, assistant engineer, C. & O., Russell, Ky.; W. S. Lacher, managing editor, *Railway Engineering and Maintenance*, Chicago; J. H. Lynch, roadmaster, C. R. I. & P., Chickasaw, Okla.; F. L. McMillan, supervisor, Alton, Joliet, Ill.; C. T. Mulcahy, road-

Tie Plugs Should Be Driven to the Full Depth of the Spike Holes

master, S. P., Niland, Cal.; G. M. O'Rourke, district engineer, I. C., Chicago; A. H. Peterson, roadmaster, C. M. St. P. & P., Chicago; E. P. Safford, supervisor, N. Y. C., Silver Creek, N. Y.; R. L. Sims, district engineer maintenance of way, C. B. & Q., Galesburg, Ill.; O. Surprenant, roadmaster, D. & H., Schenectady, N. Y.; E. A. White, roadmaster, C. & N. W., Wall Lake, Iowa.

Discussion

J. B. Kelly (Soo Line) recommended that all 1-A rails and short rails be kept out of curves, saying that for all except long curves the difference in length between the inner and outer rails can be adjusted by placing the short rails on the tangents immediately adjacent to the curve. He also complained that he is getting rail which is so badly out of square at the ends that not a few rails that are in contact at the base have as much as 3/16-in. gap at the level of the running surface.

He emphasized the desirability of placing the thermometer on the shaded side of the rail when taking rail temperatures. He also called attention to the necessity for applying anti-creepers to resist the movement of rail, regardless of the direction of creepage. This opened an extended discussion on rail creepage and a number of instances were cited where, on double track, one rail crept in the direction of traffic and the other against traffic. One case was mentioned where both rails crept opposite traffic after new rail was laid and surfaced.

President Haley brought up the question of the desirability of surfacing rail as soon as it is laid, and several speakers recommended intervals varying from 24 hr, to 3 months. All agreed, however, that if loose ties are tamped solidly there should be no damage to rail if it is not surfaced for three months.

J. Stewart (S.P.) said that shims should be removed before trains are allowed over the track. Several speakers recommended wooden shims to avoid the necessity for doing this, while others advocated the use of metal shims that can be inserted from the side. Mr. Kelly called attention to the fact that if metal shims are inserted in the morning on cool days, the expansion will be distorted when the rail heats up during the day, unless the shims are removed promptly.

The Roadmaster's Responsibility for Tie Life

By H. R. DUNCAN

Superintendent of Timber Preservation, Chicago, Burlington & Quincy

RAILROADS that follow the best tie practice purchase and handle their ties in accordance with the recommended practice of the American Railway Engineering Association. The tie specifications developed by that association are the result of many years of study by competent engineers who have given every consideration to the qualities needed in a tie and have endeavored to utilize all of the timber that is available for tie use. To insure long and economical life from our ties, they are given careful inspection to see that they conform to the specifications.

On many properties the organization responsible for the purchase and inspection of track ties observes the production methods to make certain that the ties purchased are handled carefully from the time the trees are cut until the ties are finally offered for inspection. More satisfactory results are secured from ties that are manufactured promptly after the tree is cut, and piled properly on suitable foundations in the woods, in yards, at railway stations or at river landings.

Time of Cutting

Some authorities are of the opinion that more satisfactory results are secured from ties manufactured from certain species of wood if they are winter-cut. Others are of the opinion that winter cutting is not as important as careful handling after the tree is cut and up to the time the tie is

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treated. After the ties have been inspected, they are moved to the treating plants and piled for seasoning. It is important that the yards in which the ties are stored be well drained and free from vegetation. The seasoning period depends on the species of wood, the time of the year, the location of the seasoning yard, the temperature, rainfall, humidity, and wind velocity. Therefore, no one definite length of time can be specified, and the time varies from 2 to 12 months. However, during the seasoning period the ties are watched closely so that decay does not develop prior to treatment.

Many ties manufactured from broad-leaved trees split considerably during the seasoning period. On many properties the plan is to apply anti-checking devices to the ends of these ties in an endeavor to retard the splitting. After the ties have seasoned sufficiently to permit satisfactory penetration of the preservative, they are treated under pressure with a sufficient quantity of preservative to insure freedom from decay as long as they are strong enough to serve their purpose.

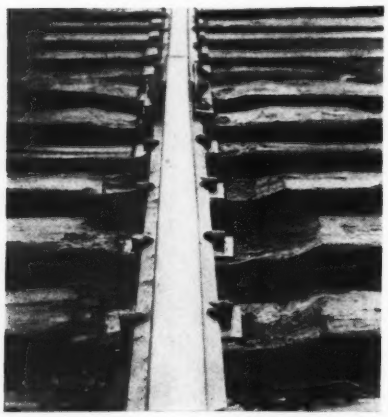
In the past many railroads used untreated ties. However, a high percentage of the more decay-resisting woods was used and the average life of the untreated tie was probably about ten years. Today the majority of the ties used are treated and the average life of treated ties on the various railroads will probably be from 20 to 25 years.

Vast Economies Effected

The fact that treated ties are generally used has resulted in a tremendous reduction in the number of ties necessary to maintain the railways. Nevertheless the cost of ties has increased materially over a period of years. It is estimated that the present average cost of all ties, treated and untreated, installed in track is about $1.50, and the cost of treated ties installed in track is approximately $2 each. This includes the cost of the tie plus handling, seasoning, treating, installation, and freight paid connecting

lines, but disregards the cost of "company" haul. However, if we had not taken advantage of the refinements in selecting, treating, handling, and using ties during recent years, our tie bill would now be ever so much greater.

The Class 1 railroads of the United States and the large Canadian roads report the use of approximately 58,000,000 crossties during 1936, 71 per cent of which were treated. Using the estimated cost of $1.50 each, installed in track, the total tie bill for these railroads comes to about $87,000,000. This tremendous expenditure is handled under the direct supervision of the members of your organization and it is of the utmost importance that you fully realize your responsibility in connection with this expenditure and exercise the very best judgment in handling all phases of tie replacements.



Inadequate Plates Shorten Tie Life

Report Unsatisfactory Ties

We will assume that when the ties reach you, they have been purchased and inspected in accordance with the recommended practice to which I have previously referred; they have been handled, seasoned, and treated under the supervision of men trained in that particular line of endeavor and that, when you receive the ties, they are perfect ties.

Some of the ties may not be perfect when you receive them and, in case they are not, it should be your duty to make an immediate report to those responsible for the quality of your ties. Generally speaking, however, the standards of inspection, seasoning, handling, treating, etc., are very high throughout the country at the present time.

Many users of treated ties are of the opinion that the preservative should penetrate the wood completely. This would be very desirable but it is something that has not thus far been possible of attainment. The depth of penetration of preservatives in treated wood varies considerably. It is affected by the amount of moisture remaining in the wood, the species or the character of the wood structure, which is often determined by growth conditions, the amount of heartwood in the individual piece, and the treating technic employed.

To penetrate the more refractory woods, such as Douglas fir, more thoroughly, many railroads incise the timbers prior to treatment. This is accomplished by passing the sticks between rollers that are faced with incising teeth which penetrate the wood to a depth of about ¾ in. This results in greater penetration of the preservative but still only slightly deeper than the ¾-in. incision.

Why Ties Fail

Ties fail in service from two principal causes; mechanical destruction and decay. Actually, a rather high percentage of the ties which fail indicate both mechanical destruction and decay. A very careful inspection of many thousands of failed ties discloses very definitely that decay accelerates mechanical destruction and mechanical destruction enables decay to enter the untreated portion of the tie. The mechanical destruction of a tie can be materially reduced by careful handling and the use of tie plates of adequate area and thickness.

Decay in wood is caused by low forms of plant life called "fungi." There are many strains or types of fungi, but their growth in all cases is dependent upon moisture and air at the proper temperatures. In most places there is sufficient moisture in the air for at least certain types of decay. Decay will grow at very low temperatures but growth is more rapid at a temperature of 70 deg. F. or higher. All effective timber preservatives contain poisonous materials, in the presence of which fungi will not grow.

It is important that treated ties be handled carefully so that the protective layer of preservative-treated wood will not be broken and the untreated wood underneath thus exposed to infection and decay. This protective layer, in many cases, as for example in white oak and fir, is only a small fraction of an inch thick. A puncture made by a sharp tool, such as a pick or a shovel blade, may afford the opening through which decay may enter and start the destruction of the untreated portion of the tie. Failure of treated ties in service is very largely caused by decay of the untreated portion of the tie, due to infection which is introduced after treatment through season checks, which occur and enlarge after the tie is in track, or through or around spike holes where spikes have been driven elsewhere than in the prebored holes, or by accidental punctures which occur when the tie is handled or pulled into place by the use of shovel blades, picks, mauls, etc.

No definite rule can be established that can be applied to all railroads or even to the various types of line on any one railroad, but in selecting ties for various classes of lines, consideration is given to the geographical location of the line and its relation to the source of supply of timber, the location of the treating plant, and principally to the amount and kind of traffic which will be handled over the line. When ties are shipped to you, it is quite important that they be distributed strictly in accordance with the policy that has been determined by officers of your railroad who are responsible for maintenance standards. Usually there is still considerable opportunity for the section foreman and roadmaster to improve the results secured by selecting the larger ties free from checks for service as joint ties and using the smaller and checked ties where they will more adequately serve the purpose for which they are intended. Often when we do not have an adequate allotment or authorization of the proper size of tie, we are prompted to make substitutions. This is a serious mistake and, if the facts are properly presented to the management of your railroad, you should

An Example of Mechanical Destruction—Below, Section Through Tie Between Rails —Above, Section Through Tie at Rail Support

be able to obtain the size and species of tie that has been shown to be the most economical.

Some of the physically weaker woods, which may give satisfactory life in some types of track structure, are not strong enough to withstand the abuse to which they are subjected when thrown over the top of a coal car or across a rail or another tie. I have known of roadmasters who did not exercise the proper care in unloading but who were very quick to condemn the quality of the tie because it was broken in unloading. Frequently some of the physically weaker woods or ties containing abnormal wood structure, break in track because the track is center bound. Whether new ties break in handling or in track is very largely dependent upon the species of wood, the height from which they are dropped, and whether decay or abnormal wood structure is present, but by careful handling and avoiding center bound track conditions, in so far as possible, the life of these ties will be materially increased.

Good Practice in Handling Ties

On some roads it is the plan to send ties out in advance of the time they are actually put into track. When this is done, it is a good plan to pile the ties as close together as possible. Close piling reduces evaporation of the water and lighter fractions of creosote from within the ties. Experience has also shown very definitely that if this is done less checking occurs than if the ties are thrown out promiscuously along the right-of-way and allowed to remain there some months before installation. There is also considerable objection to throwing them along the right-of-way, for the reason that they are in the way of weed mowers, weed burners, ditchers, etc.

The average cost of maintaining a treated tie in track is estimated at 10 or 12 cents per year, or from $300 to $400 per mile per year. Therefore, it is quite important that the roadmaster be very careful in supervising tie renewals to make certain that the maximum life is obtained before the ties are removed from track. If the ties are being spotted in when renewals are being made, and a tie is in condition to remain in track another year, giving due consideration to the condition of the ties adjacent to it, and it is decided to leave it in, 10 or 12 cents per year is saved. On the other hand, if you are surfacing the track and you have a tie which is good for only one additional year, you would not hesitate to remove it because your estimate of the cost of disturbing the track a year after it had been resurfaced would be much greater than the saving of 10 or 12 cents for the tie. We cannot adhere to any hard and fast rule in this regard that is applicable to all railroads or even to all types of line on one railroad. It is, however, a phase of your work that has a bearing on the life of ties and one to which you should give very careful consideration.

Checking and Rail Cutting Is Shortening the Life of These Ties

Advantage of Preboring

Years ago ties were not bored and adzed prior to treatment and the result was that it was frequently necessary to adze them in the field. If this is done after the ties have been treated, the protective coating of treated wood is removed and infection, and then decay, follows. When spikes are driven into ties that have not been prebored, the fibers adjacent to the spike are bent when the first spike is driven into the tie. Later the wave motion of the rail raises the spikes and ultimately they are redriven. After this has occurred two or three times, the majority of the wood fibers around the spike are broken and, particularly in the case of ties that are manufactured from wood that resists complete penetration with preservatives, the untreated wood becomes infected and decays. Properly bored ties usually have a considerably greater quantity of preservative under the rail and around the spike holes than do non-bored ties. Consequently infection and decay are retarded. A committee investigating this a number of years ago also determined that the holding power of the spike was actually increased in the bored tie as compared with the non-bored tie. This is due to the fact that sufficient wood fiber is removed by boring and fewer fibers are broken when the spike is driven.

Guard Against Injury

When relaying rail, it is usually necessary to adze the ties for larger tie plates. The most satisfactory method of doing this is to use power adzers. Frequently new ties that were adzed before treatment have been put into track four or five years before the rail is relaid and are in excellent condition but, unless extreme care is used, additional adzing is done and the advantage of treatment is lost due to the fact that the tie is adzed too deeply and untreated wood is exposed to infection and decay. When it is necessary to adze treated ties, they should not be adzed any deeper than is absolutely necessary and, after adzing, they should be painted with a liberal quantity of creosote. Usually when we are relaying rail, so many men are employed and such excellent progress is made in relaying a predetermined amount of rail each day that sometimes the refinements that will result in prolonging tie life can be easily overlooked. However, by proper supervision, satisfactory results can be secured. One important railroad, whose tie record is a very enviable one, follows the plan of assigning an inspector from the treating organization to each rail relay gang with the idea of offering suggestions and assisting the gang in avoiding unnecessary damage to the ties. Certainly there is so much involved in work of this kind that the inspector would not have to save many ties each day to pay his salary and expenses and still realize a profit.

Spike holes should be reused or plugged with treated plugs, except

that prebored holes into which spikes have not been driven should be left unplugged. The use of tie plates results in longer life of ties and it is important that tie plates of adequate size be applied to all new ties when they are put into track. In case ties are damaged by derailment or dragging parts of equipment, they should be adzed with a sharp adze to remove the crushed fibers and a liberal quantity of creosote applied to the adzed surface. In locations where ash pans of locomotives are emptied, ties are frequently destroyed by fire. This damage can be reduced by covering the ties with sheet metal. It is also suggested that track men make a wire report to the superintendent of all cases where ash pans are emptied without putting out the fire, so the necessary action may be taken with the enginemen responsible.

Many ties have been damaged by weed burners. Usually I have been informed that the only ties damaged are those that are rotten and are not worth protecting. However, I have frequently observed new ties afire after the weed burner has been operated over them. Weed burners should be followed with a sufficient number of men and adequate equipment to insure that all fires are extinguished after the burners are operated over the ties.

The heaving of track frequently necessitates the use of shims and braces. When they are applied, it is necessary to drive a number of extra spikes in the ties in locations other than the prebored holes. Consequently we do not secure long life from ties where we have this difficulty with the track. If heaving could be avoided, we could anticipate somewhat longer life from our ties. Whether this additional life would be sufficient to pay for the cost of correcting the condition which causes the heaving is something that you maintenance men will have to determine.

In conclusion, let me point out that the outlay for ties is the largest single item of maintenance of way expense on our railroads and whether we receive full value from the money expended lies in your hands. The most essential things to observe in an effort to secure the best results from ties are to make certain that no ties are replaced that still possess some service life and, when treated ties are used, see that they are handled in a manner which will insure the most effective results from the money that has been expended for treating them. This can be accomplished by taking every precaution to prevent the treated portion of the tie from being broken and thereby permitting exposure of the untreated wood.

Discussion

J. B. Kelly (Soo Line) asked Mr. Duncan if he thought that the application of unheated creosote to newly-adzed tie surfaces was effective in preventing decay. Replying, Mr. Duncan referred to the fact that the American Wood Preservers' Association recommends the use of hot creosote, and said that he is in agreement with this recommendation. In reply to a question put by J. E. Griffith (Sou.) as to how gum ties compare with red oak ties, Mr. Duncan replied that while many roads have obtained excellent service from gum ties, gum is the most "treacherous" of all the woods used for ties, and stated that the performance of creosoted gum ties in the track depends to a great extent on the care that is given them previous to treatment.

He explained that gum wood is easily infected and that the decay spreads rapidly after infection sets in. It is the practice on some roads, he said, to saw off the ends of gum ties before treatment as a means of determining whether decay is present. About five per cent of the ties are eliminated in this manner, he said, so that at the outset a saving is effected by withholding from the track ties that would require renewal within a relatively short time. In discussing the life of creosoted gum ties, Mr. Duncan stated that he has seen such ties removed from the track because of decay after 5 or 6 years' service but in other instances, a service life of as much as 30 years has been obtained.

A. Chinn (Alton) asked Mr. Duncan's opinion concerning whether weed burners leach the preservative out of ties. In reply, Mr. Duncan said that some years ago he was definitely of the opinion that weed burners did damage the ties in this manner but described recent tests made on his railroad, results of which indicate that it cannot be proved definitely that the ties are affected adversely. R. N. Wade (Chicago Rapid Transit) inquired if Mr. Duncan advocates the piling of treated ties closely together. Replying in the affirmative, Mr. Duncan stated that when ties are piled in this manner there is less loss of the lighter fractions of the creosote and less checking occurs.

J. L. Gallavan (U. P.) described the practice on his railroad in unloading ties. All the ties to be inserted on each general manager's district, he said, are distributed, along the track by one gang which operates over the entire district. Mr. Chinn suggested that perhaps the answer to the question as to whether ties should be distributed or piled depends on whether they are to be used immediately or sometime later. Referring to Mr. Dunan's statement that ties distributed along the track present obstacles to the operation of weed mowers, Mr. Gallavan said that it is the practice on his railroad to distribute ties and insert them in track in advance of the growing season.

C. W. Ayling (A.T. & S.F.) asked Mr. Dunan his opinion concerning the effect which the quantity of preservative used has on the checking of ties. In answering this question, Mr. Duncan said that it is one in which a number of variable factors are involved, among them being the species of wood and the climatic conditions prevailing at the particular installation, so that it is not possible to make a statement applying to all railroads.

Replying to a statement made by Mr. Chinn that it has been his experience that ties treated with a mixture containing crude oil are less likely to check than those that have been treated with a higher percentage of creosote, Mr. Duncan said that the practice on his railroad is to use a 50-50 mixture by volume of creosote and petroleum. This mixture, he said, has proved economical and has resulted in a minimum of checking. However, he emphasized that this is his personal opinion and that the prevalence of variable factors makes it impossible to state an opinion applying to all railroads.

On the Delaware & Hudson, Showing Continuous Welded Rails, Equipped With New Plates and M&L Fastenings, Ready to Be Lined Into the Track

The Operation of Motor Cars to Avoid Accidents

Report of Committee

THE safe operation of motor cars is of especial importance at this time. Most railroads are speeding up train schedules to meet public demand for faster transportation. In the last few years super-speed trains have captivated the fancy of traveling America to a degree unhoped for by even the most sanguine railroad management. Too, there has been the need for economy on the part of all roads, making it imperative that expenditures be reduced all along the line. This has resulted in the lengthening of sections and in the reduction of forces, with the consequent need for spreading the labor allotment more thinly over the operated mileage. More mechanization of work has been the rule. Especially has the use of motor cars become an effective aid in reducing costs in the maintenance of way department.

A. H. Peterson
Chairman

A quarter of a century ago the railroads of this country began to replace hand cars with motor cars. The latter eliminated the drudgery of pumping a friction bearing hand car, oftentimes for several miles against a strong wind at the close of a day's work. They also saved a considerable percentage of the working time which could be applied to improving the track, and which, before the advent of the motor car, was a total loss. It was, perhaps, inevitable that the motor car, offering the opportunity for high speed, should bring about more accidents. Usually it is found that failure to control speed is the direct or contributing cause for the alarming number of deaths and injuries that are today chargeable to motor car operation.

There are now about 65,000 motor cars in service on the railways of the United States. If ten miles per day is taken as a fair average for their operation, it then follows that these cars run 650,000 miles per day over our railroads. It is not surprising, therefore, that the Interstate Commerce Commission figures on casualties attributable to the operation of these cars in maintenance of way and structures service reveal that during the year 1935 there were 30 maintenance of way employes killed and 616 who received reportable injuries.

Nor do these figures include the manifold accidents resulting in a heavy financial loss due to the demolition of cars or other damage to motive power in which there were no personal injuries. Let us compare these figures with the table on page 722. One will observe that the total number of non-train accidents to maintenance of way and structures employes for the entire year of 1935 resulted in 50 killed and 3306 injured. Thus motor car operation was responsible for the deaths of 30 per cent of all the maintenance of way employes killed in accidents where trains were not involved and for 16 per cent of those injured in such accidents. Motor cars were also responsible for 14 killed and 32 injured in train accidents where these cars were struck by locomotives or cars.

That motor car accidents are usually serious is emphasized by the fact that while they comprised only 5.2 per cent of the total non-train accidents in 1935, they produced 7.3 per cent of the fatalities. The ratio of those injured to those killed for the entire group of non-train accidents in the maintenance of way department in the same period was 66.1, while for non-train motor car accidents the ratio was 36.5. In other words 43.7 per cent of those involved in train motor car accidents were killed outright. The total number of maintenance of way and structures employes killed in all classes of accidents in 1935 totaled 126.

Nor has there been much improvement since 1930, especially as regards the number of employes killed in motor car train accidents. While 47 per cent less man hours were worked in the maintenance of way department in 1935 than in 1930, the reduction in the number of fatalities was only 12½ per cent and injuries were reduced only 5.8 per cent. With these figures in mind, it is obvious that corrective measures are necessary to eliminate the large number of fatalities and casualties. The value of motor car transportation for maintenance of way department forces is seriously threatened by the large number of serious accidents that have followed in its wake.

The analysis of these motor car accidents to determine the elements involved, leads to only one conclusion —that failure on the part of the employe to exercise good judgment or to abide by existing rules is the most important factor contributing to accidents and injuries. These man failures may well be included under what we may term the human element. No small proportion of the motor car accidents are due to unusual weather conditions, irregularities of ground and the vagaries of traffic density, etc. These factors may be grouped under a second broad classification, as operating conditions. There remains the third and final element—the motor car itself, including its design, condition, appurtenances, type and suitability for the need it is expected to fill. Let us consider these elements in the order of their importance.

The Human Element

The "human element" offers opportunity for educating and training the personnel who utilize the equipment. Only those men should be foremen who appreciate the responsibilities of their position and who are willing to abide by and to enforce existing rules. Motor car operators should be mentally alert, have good eyesight and hearing and a knowledge of operating rules. It is more essential that they be men of good judgment and the desired degree of dependability than that their other physical attributes be of the best.

Since on branch lines, the foreman is usually his own motor car operator, he should combine the qualities of a high-grade foreman with those of a careful motor car operator. It is necessary that he be able to detect defects in his car in sufficient time so that they may be repaired before an accident occurs. He should have a

working knowledge of the engine and know what his car can reasonably be expected to do under any condition.

Only one man should be in charge of the motor car. Where several men are entrusted with its care or operation the net result oftentimes is that no one becomes adept and there is no actual feeling of responsibility on the part of any one. The roadmaster and supervisor have an unmistakable duty to select high-grade men for foremen and operators. These men should be given opportunity to learn something about gas engines and how to make repairs. Above all, they must bring the lesson of caution to every man who rides a motor car.

This Type of Accident Is Entirely Avoidable

While Interstate Commerce Commission figures are not available for use in determining the causes of motor car accidents in detail, statistics from one important middle western road indicate that derailments to motor cars were responsible for 34 per cent of their motor car accidents, back firing 25 per cent, collisions 17 per cent, falls from cars, boarding and alighting 12 per cent, lifting cars on and off the track 8 per cent and miscellaneous 4 per cent. Nearly all of these accidents were due to human fallibility and could have been avoided with proper judgment or strict adherence to the rules. As such, they belong to that class of accidents that are often referred to as man failures.

To prevent motor car derailments, weeds should be mowed along the shoulder, at crossings and the entire right-of-way if possible. This will improve visibility. Often serious accidents occur because of dogs, chickens, or children darting from the side of the track directly in front of the motor car. Likewise, all scrap spikes, tie plates, etc., should be diligently cleaned off the right-of-way for if left lying there they are oftentimes placed on the rail ahead of trains or motor cars by children or trespassers. For the same reasons, new material should not be distributed too far in advance of its application.

Another fruitful source of motor car derailments is plugged flangeways at public crossings. Train accidents often result from this cause. Obviously the usual light motor car is especially likely to derail if flangeways are not kept well cleaned. On dirt or gravel highways, drags and scrapers are frequently responsible for depositing material on the crossing or in the flangeways. The attendant danger should be called to the attention of all such persons and a report made by the section foreman to his superior officer.

Gangs working on the track should keep the top of the rail clear of ballast or other material at all times. Motor cars or trains may be run at any time without warning.

Material Falling Off Car

Nearly every trackman knows personally of a motor car accident, usually a serious derailment, due to tools or track material falling off the car. Tools should be carefully stowed in the tool trays on the side of the motor car, with all bars on the bottom of tray. Picks, adzes and scythes must have the handles removed and the sharp cutting edges protected. In no case should tools and material be piled higher than the top of the tool tray. Care should be taken in tying down or securely fastening any light tools which might shift.

The ordinary section car is capable of hauling six or eight men and their tools safely. Where it becomes necessary to transport tools for more than that number, a push car should be used for the excess. This push car must, of course, be provided with a box of sufficient height to prevent the materials or tools from falling off.

When a greater number of men are to be hauled than can be seated on the motor car, regulation trailers should be used. These cars, as well as all push cars, should always be pulled, never pushed ahead of the power car. Each trailer should have a brake, in charge of a regularly delegated man who should be careful and see that all men are seated and that none of them have their legs between or off the side of the cars. Only in emergencies should heavy material be carried on motor cars and in such cases the load must be confined to the capacity of the car.

Some form of approved coupler must be used when trailers or push cars are towed. Many lives have been lost because of the use of some makeshift device for coupling cars together, due to its becoming disengaged at its forward end and dropping down against a tie. Most roads use a standard draw bar, usually about eighteen inches long. The end of the motor car where the coupling is to be made is provided with a steel ell plate of the proper design, which is linked to the draw bar with a bolt or steel pin. The end of each push car and trailer is similarly secured. Couplers made with a draw bar longer than the distance from the top of tie to the top of the draw bar when in position have been responsible for serious accidents, due to the bar becoming disengaged and striking a tie, derailing the car or cars.

Speed or a combination of speed with various other factors leads to many derailments annually. A motor car has no track rights unless operating under regular train orders. Such being the case, it is essential that the speed be limited to the degree necessary to insure a stop clear of an obstruction. Most roads agree that twenty miles per hour is permissible on tangent track and around light curves in daylight. Ten miles per hour is the maximum fixed during stormy or cloudy weather, around sharp curves, over frogs, railroad crossings, over high or long bridges and trestles, through tunnels and through cities and towns where the track is not elevated or depressed. Speed is also limited when passing passenger stations.

The speed must depend on many factors aside from these, however, such as the load being carried, the condition of the track, the number of crossings at grade, etc. Great care must be exercised while operating motor cars through remote control switches which may suddenly be thrown under such cars or while passing through the spring rail side of spring frogs. Motor cars should be pushed through if not heavily loaded. If run through under power, the mo-

mentum may well be reduced to half that of walking speed.

Backfiring of engines while being cranked has been responsible for a large number of accidents. To start a free running track car engine, the spark should be retarded and the starting crank pulled up when the engine is compressing the charge in the cylinder. If the charge is ignited before the piston is at the top of the stroke the crank will be thrown violently backward and is liable to injure the man using it. Care should be taken to keep the fingers and thumb on the same side of the crank handle, and the body as far away as possible. Few roads prescribe the exact way in which a motor car engine shall be started. Pushing the car offers a safe way of starting balky motor car engines, provided the car is stopped long enough to allow the men to get on after the motor has caught.

The most disastrous accidents dealt with under the Human Equation are those involving collisions with trains, with automobiles and with each other. Of 46 persons injured in 1935 in collisions with locomotives or cars, 14 were killed. No appreciable reduction has been made in these accidents since 1930. In the latter year, 50 persons were injured in collisions, of which number 16 were killed. The problem of educating maintenance of way forces to the end that these costly accidents may be eliminated is one that merits the earnest endeavor of all maintenance of way officers.

Car Inspection

Before using the track motor car, it should be thoroughly inspected, care being taken that all bolts, cotters and nuts are in place and tight, that gasoline feed pipes and connections do not leak, that axles are straight, wheels and bearings are in good condition, that brakes are properly adjusted and that the wheel gage is correct. All bearings and boxings should be well lubricated. Just after starting the car, the brakes should again be tested.

The foreman or operator of the motor car should at all times carry a standard watch, checked daily to insure its dependability. He should know that it is wound and accurate. A copy of the current time table should at all times be carried on the foreman or operator's person. Both should be thoroughly familiar with train schedules over their territory. The gasoline tank should be checked to see that there is a sufficient supply for the day's run. Accidents have happened on account of the gas supply running out, stalling the motor car at some point where it could not be set off.

Before starting the day's work, the foreman or motor car operator should secure a written lineup of all trains affecting the safety of his motor car movement for the succeeding hour. This may be procured from the agent, telegraph operator or dispatcher, providing that such information can be obtained without calling the agent or operator before or after assigned hours of service. After receiving the lineup in writing, the operator of the motor car must read it aloud to all persons on the car. It must be understood that this lineup is not to be relied upon as absolute, but is to be regarded only as an added precaution. The motor car must be operated upon the assumption that a train may be expected from either direction, regardless of the line-up. Some roads operate their motor cars entirely under train orders; obviously the above does not apply to such railroads.

To promote safety and to fix the responsibility for accidents more clearly train dispatchers should make a record in their train order book of each lineup given to motor car operators. This record should show the time and office call to which the lineup was sent. If the lineup is received by telephone it should be repeated back by the employee receiving it to guard against error. Before issuing a running order to an extra train during the time that trackmen are working, the train dispatcher should examine his record of lineups for that day. If the extra is not shown in all lineups given, the conductor and engineman of such extra should be so advised in their running order as follows: "Engine No. 90 run extra A to B track. Track crews have not been notified about this extra."

Full flagging equipment must be carried on the motor car and stowed away in a dry place easy of access. The usual flagging equipment for days consists of 3 red flags, 12 fusees and 36 torpedoes. For night operation, 2 white lanterns and 2 red lanterns are also carried, in addition to the light carried on the front of the car as a headlight and the red one provided at the rear as a tail light.

Gang Organized for Quick Action

The members of the crew should be required to sit in designated places on the motor car at all times while the car is in operation. Men should not sit too close to the opening of the water jacket on water-cooled motors or burns may result. One man should be assigned to sit facing the rear, with a red flag in his hand, prepared to warn of approaching trains and to give flag protection if necessary. The men on either side of the car should be given specific duties of watching tools, observing telegraph wires for defects and assisting in keeping a careful lookout ahead. It is advisable that the man in control of the motor car confine his attention to the car itself whenever this is necessary. Therefore, there should be a head end lookout in addition to the operator.

Smoking should not be permitted on motor cars. Not only may fires be caused during dry weather, but the ashes or sparks may blow into another man's eyes and cause a serious injury. Neither should the motor car be tinkered with while running, except if necessary to adjust the carburetor. Horse play among the men or unnecessary conversation must not be permitted to distract attention from the duties to which each man has been assigned.

It goes without saying that motor cars must be removed from the track when work is to be performed on the track. On branch lines where few trains are run, there is a temptation to keep the motor car on the track and push it along as the work progresses. This practice will lead to an accident eventually if continued.

On Double Track Lines

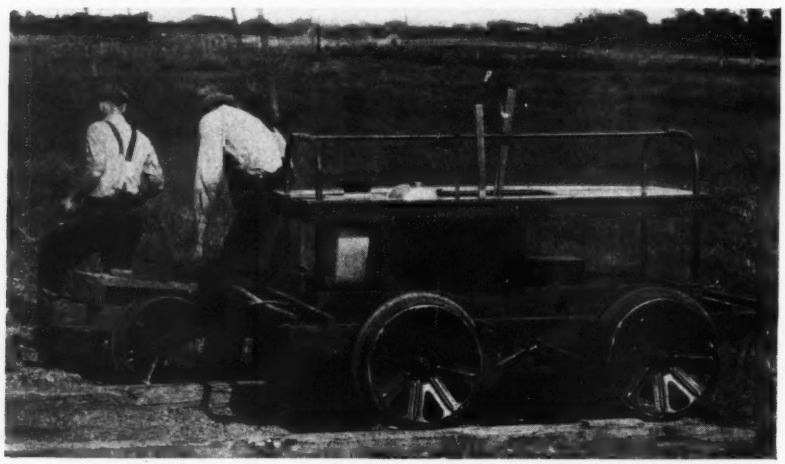
Motor cars, unless otherwise authorized, should proceed with the current of traffic on double track lines. Cars should be stopped during the passage of trains on the adjacent track. Employes should dismount from the car and stand clear of both tracks while trains are passing. Care should be taken to observe the signals that are being carried and to note whether there is a following section. An extra train may be run on the time of a regular train. Mistakenly a car might be set on the track immediately following, under the impression that the regular time-card train had passed. Engine men should be on the lookout for motor cars or men working and sound whistles and bells to give sufficient warning of the approach of their train.

Where more than one motor car is to be set on the track at one place, they should not follow each other at too close an interval. The usual practice is to allow 1000 ft. between any two cars or between a motor car and a moving train. Motor cars should not be coupled together without the permission of the roadmaster, division engineer or superintendent.

When motor cars are heavily loaded, a flagman must be sent in each direction the required distance prescribed by local rules, prepared to stop any train which may be approaching. At the approach of the train, the flagman must place a lighted fusee on the

engineman's side of the track, proceed a short distance further and place two more torpedoes on the engineman's side of the track, after which he should return to the fusee and give the proper stop signals.

The motor car set-off is a most important adjunct of motor car safety. With the much faster speeds of trains today and with the tendency to diminish the permissible speed of motor cars, it is necessary to have set-offs at strategic locations to permit track motor cars to be removed from the rails



A Good Example of a Motor-Car Setoff with the Car Properly Blocked

before being struck. Motor car set-offs along fills may best be constructed of earth. Where track machines such as Jordan spreaders may be operated from time to time, the set-off should be constructed of wood so that it may be removed during the ditching operation. In all cases, it should slope away from the track. It should be long enough to permit the car to be pushed to a safe clearance distance from passing trains, six feet or more from the near rail. The lumber used in constructing the set-off should be sound. Infrequently an accident results where the motor car breaks through the set-off. Where motor cars are heavy and gangs small, a light portable platform is sometimes constructed on which the motor car may be turned. When not in use, the platform is removed and laid beneath the set-off. Where permanent planks are spiked between the rails at set-offs, flanger signs must be erected in the winter and flangeways kept cleaned out the same as for other crossings. While resting on the set-off the motor car must be blocked and if the gang is working at a considerable distance, locked as well. Trespassers have been known to set an unlocked motor car on the track, start the engine and send it away riderless with an open throttle.

Regular drills should be held in setting the car on the track and particularly in setting it off quickly, if occasion should arise. Where eight or ten men comprise the regular gang, the ablest and most active should be assigned to act as the emergency set-off crew.

Each man should lift at a previously assigned point on the car during these drills. Surprise drills should be called for by the foreman under various conditions to enable the car to be removed from the track quickly in an emergency. Men should be instructed to set their feet apart if possible while lifting and to do the actual lifting with the strong leg muscles, rather than with those of the back. Each man should lift his share of the weight and should be cautioned not to release the weight suddenly to avoid transferring a greatly increased weight suddenly to the other men on his end. The use of a stop watch and the keeping of a record of the time necessary to get the car off the track will bring surprising results.

Crossings at grade are a special hazard to motor car operation. Motor cars must be under complete control when approaching such crossings. Where traffic is heavy one or two men should flag vehicular traffic to a stop and the car then pushed across the crossing. Motorists are unfamiliar with track cars and do not realize that the acceleration rate of a track motor car engine is not equivalent to that of an automobile and that the friction hand brakes will not stop a railroad motor car operating on steel rails as quickly as the highly developed automobile brakes. The motor car operator must realize his position. He is "persona non grata" and must beware of and be prepared to avoid getting in the way of any vehicle which may cross the track at a crossing, any animal that may run in front of his motor car and any train or car that may be operated upon the track.

Falls from track motor cars frequently cause most disastrous accidents. A report comes as this is written of an accident on a Mexican road which resulted in the death of 25 men. A laborer wearing a pair of overalls with turned-up cuffs let his leg slip over the side of the car momentarily. The cuff caught in a cotter key on the axle, causing him to fall off and underneath the car wheels. The car was derailed, turned over on top of the men and caused the death of twenty-five of them. Ragged overalls or sleeves may be caught in a moving part and cause a serious injury.

It is recommended too that the motor car operator, foreman and any other men whose duties make it necessary for them to face forward while the motor car is in operation, wear goggles, at least during the insect season. It is common for grasshoppers and locusts to strike the face with considerable force. It the eye is struck, a serious accident could result. Smaller insects often enter the eye. Likewise, during high winds there is the hazard of other foreign bodies lodging in the eye.

During the winter months a motor car is a cold place in which to ride. For that reason, there is a temptation to bundle up heavily for a long trip. Sometimes long overcoats are worn tucked in around the legs. If it should become necessary to move quickly in order to make an emergency set-off, there is a danger of falling while getting off the car. Coats should be worn of not greater than three-quarters length to facilitate getting on and off cars quickly and safely.

Push From the Rear

Men must not be permitted to get off moving cars, or to throw tools and material off cars until they have been brought to a full stop. When cars are pushed to start them, all pushing should be done from the rear. After the engine is started, the car should be brought to a stop while the men get aboard. The youngest and most active men should do the pushing as there is less likelihood of their injury by falling.

When brakes are to be applied, motor car operators must call a warning to other men on the car so they may have an opportunity for bracing themselves. A sudden start, but more particularly a sudden stop, may cause a man who is unprepared to pitch headlong over the end of the car or into the safety rails with sufficient force to injure him severely.

Motor cars, if not prohibitively heavy, should be lifted through main line hand throw switches when they are not lined for the motor car movement. The foreman should, when necessary, handle the lining of the switch personally. After the motor car has passed through the switch and the foreman has lined and locked it for the main line movement, he should call the attention of one or more of his men to that fact. It is not uncommon for a foreman to start worrying about whether he lined a switch back properly after he is several miles away. If he has handled it as mentioned here, he may easily satisfy himself by asking the men whose attention he called earlier.

Operating conditions are so variable that it is not possible to attempt an enumeration of them all. Weather conditions may render it unsafe to operate the motor car at all. Sharp curves which limit visibility are sometimes responsible for disastrous collisions. Steep grades in mountainous territory offer another problem. Operation on single track lines differs widely from that on multiple lines. In fact one eastern road is experimenting with motor trucks operated over the highways in place of motor cars, due largely to traffic density and the danger of motor car accidents.

Frosty rails or rails covered with snow present another danger. Suffice it to say that the range and variety of operating conditions on our railways present no insurmountable obstacles to safe motor car operation. Common sense and good judgment are the most essential safe guards. These, together with the necessary modification of the suggestions made earlier, will if faithfully applied conquer the special hazards found under adverse operating conditions.

The car itself is the final element with which we deal. In the early days motor cars were usually make-shift affairs. Ordinarily a light gasoline engine of two or three horse power was mounted on an old hand car frame from which the walking beam and handles had been removed. Breakdowns were the rule, accidents frequent and serious.

All That Was Left of One Car After a Collision—An Example of Careless Operation

Motor cars of today are greatly improved in every respect. Manufacturers, working closely with railroad managements, offer a well designed motor car for every need. Consideration has been given to weight, a most essential safety item where gangs are small. Extention handles make it possible for a few men to handle most motor cars with practically no danger of injury to themselves. These extension lifting handles also give more foot room, making for less danger of falls. Most modern cars are equipped with wheel guards which prevent tools or other material from becoming entangled and causing injury. Mud, water or snow cannot be thrown off the wheels and into men's eyes when wheel guards are used.

This Man Is Inviting an Accident by Starting the Car from the Side

Tool trays high enough on all four sides to prevent tools from working out are standard design on the newer cars. Trays higher in front than on the other sides may be had if desired. Six inches is the minimum depth on many cars. Rail skids are standard equipment now, for the most part. These make it easy to skid the car across high rails when it becomes necessary to set the motor car off the track where there is no regular set-off.

Four-wheel brakes equipped with hangers permit brake shoes to center and equalize pressure over the entire face, making very quick stops possible. Experiments under all conditions tend to prove that brake shoes faced with soft steel offer the greatest braking power.

Wide and high safety railings across both ends of the car, together with a railing over the center of the car from one end to the other, offer a safe hand hold while getting on and off cars or in case of an emergency stop. Men frequently received injuries in the past due to a hand or a foot becoming entangled with some part of the engine. Great improvement in engine housing has practically eliminated such injuries.

Rail sweeps are provided if desired and are attached to the motor car frame immediately ahead of the front pair of wheels. Generally made of car hose, their purpose is to sweep stones, snow and small obstructions from the rail.

Controls on the motor car of today are more accessible and safer, for the reason that they are now located in clear of the space used by riders. Wheel gauges are available for measuring the wear on wheel treads and flanges.

New improvements in headlights may be had. These headlights, usually

mounted on the front safety rail, are of the gas electric generated or dry cell battery type. Though most railways still use the old kerosene lantern as a headlight on their motor cars, there is little reason to doubt that this type of headlight will soon be of the past.

Wind shields of many kinds are on the market. Under no circumstances should they be constructed of glass, this for obvious reasons. Nor would the paper to be worn through and exposes the explosive, which is rather easily detonated. To prevent accidents, each torpedo should be wrapped separately in waste or some soft cloth which will not abrade the paper shellac coating.

Portable telephones are an important safety item where lineups cannot be secured from agents and telegraph operators. They are of great value, too, where curves are numerous and

Maintenance of Way and Structures—1935
Analysis by Class of Person of Casualties Resulting from Railway Accidents of All Classes

Year	Total Casualties In Train, Train Service and Non Train Service Accidents. Railways of All Classes.		Total Casualties In Train, Train Service and Non Train Service Accidents. Class I Railways.		Total Man Hours In Thousands	Casualties Per Million Man Hours.		Train Accidents.		Train Service Accidents		Non Train Accidents	
	Killed	Inj.	Killed	Inj.		Kld.	Inj.	Kld.	Inj.	Kld.	Inj.	Kld.	Inj.
1930	266	9,801	257	9,004	836,970	.31	10.76	7	16	138	369	112	8,619
1935	126	3,925	117	3,452	460,704	.25	7.49	15	9	52	137	50	3,306

Note: Figures from I.C.C. bulletins No. 99 and No. 104.

Hand and Motor Cars Struck by Locomotives Or Cars
Total Persons

Year	Killed	Injured
1930	16	34
1935	14	32

Note: Figures from I.C.C. bulletins No. 99, No. 104, Tables No. 80 and No. 58.

Casualties To Employes On Duty In Non Train Accidents Attributable To Maintenance of Way and Structures Motor Cars

Total Persons All Railways U.S.A.

Year	Killed	Injured
1930	48	1,323
1935	16	584

Note: Figures from I.C.C. bulletins No. 99 and 104. Tables No. 104 and 104A.

it seem that any of the transparent types of wind shields are especially desirable. A wind shield constructed of water-proof canvas, high enough to reach to the height of a man's nose when seated on the car, offers the best protection from wind and cold. Experiments have demonstrated that at speeds up to twenty-five miles per hour a plane, vertical surface deflects wind upwards at an angle of about thirty degrees. This means that the cold wind will pass up over a man's head when this kind of shield is in use. It has the added safety feature of permitting full vision to both front and sides. Whatever type of wind shield is used, it should be easily demountable so that it may be dispensed with quickly if the weather becomes warm.

Motor cars should be furnished with a built-in container for flagging equipment. It should be large enough to contain all the flagging material prescribed under the rules. One road uses a wooden container with a sliding cover.

Torpedoes have caused a number of accidents while being carried on motor cars, indiscriminately mixed with bolts, spikes and other track material in the foreman's tool box. This haphazard method of loading soon causes visibility poor. Their use with large extra gangs eliminates considerable train delay. One road reports that one of its foremen constructed a portable telephone at a total cash outlay of $5.

Warning Devices

Some states require motor cars to carry a warning device of some kind, to be used when approaching grade crossings. There are a variety of such on the market, the usual one being a bell mounted on the front of the car. The clapper of the bell is operated by the foreman or motor car operator. There are also horns and whistles which serve the same purpose. Such warning devices are of somewhat doubtful value as accident preventives. There is the possibility that the motor car operator may depend on his bell or other warning device to stop vehicles at public crossings. In case they do not hear the warning or choose to disregard it a collision might result. To avoid accidents a safer course would entail that the track motor car operator keep out of the way of all other traffic and expect no one else to give him precedence.

The standard A R A color for motor cars is yellow. It is contended that this color has the greatest visibility. Every motor car should be kept well painted and clean. A bright, attractive car protects its users by being more easily seen and will ordinarily receive better mechanical care from its operator. It should not be left standing outside at night or when not in use. A suitable building should be furnished for its housing. This building should have a good strong door and lock. The floor should consist of gravel or cinders as an aid in fire prevention. The old material should be removed and fresh gravel or cinders applied frequently as some dripping of gasoline and oil will probably take place. The track on which the motor car is run into its garage may be constructed of narrow planks or old rails. Stoves should not be permitted in the same building with the motor car, nor should smoking be allowed anywhere near the car. Gasoline and oil should be stored outside at a safe distance. Gasoline cans should not be kept in the car house, but if unavoidable, non-explosive safety cans should be provided.

Gasoline Storage

The gasoline supply may be safely stored in underground tanks from which it may be pumped as required. Less fire hazard obtains and there is less likelihood of the gasoline being pilfered when stored in this manner. All gasoline tanks above ground should be grounded. Care should be taken to see that gasoline tanks are not buried in cinders as acids form which soon cause leaks.

The motor car should be supplied with gasoline at the close of the day's work and while there is still daylight. It may unexpectedly become necessary to operate the car during the night. It will then be extremely hazardous to do the refueling when lights must be used, especially if they are of the coal oil type. In metropolitan areas the motor car should be placed in its garage before the gasoline tank is refilled as there is danger of locomotive engine sparks causing an explosion. In all refueling, care should be exercised to insure that the gasoline is well funnelled and that in case of wind the car is not saturated. In no case should the ignition be left on while refueling the motor car.

Periodic Overhauling

Every motor car needs a general overhauling periodically. While light repairs can be made in the field, it is the best practice to ship cars in once in a while for complete shopping. Care should be taken that water,

gasoline and oil are drained before shipment. Axles break now and then, sometimes with dire consequences. They should be examined minutely for flaws at the factory before shipping out. Cars should not be abused by overloading, and special care used to see that too much weight is not carried on one end. A sufficiently large gasoline tank should be fitted to the motor car for the needs of an average day's cruising. A first-aid kit should be standard equipment on every motor car. The flanges of motor car wheels frequently become caught in crossing flangeways while the car is being removed from the track. Axles may become sprung and wheels bent out of alignment in this manner. The motor car of today is able to withstand a great deal of abuse, but if it is given proper care its life will be lengthened and the lives of its users not jeopardized.

Not Enough Progress

No subject in track work is covered with more detailed rules than motor car operation. Clarification of, obedience to, and enforcement of existing rules will do more to reduce motor car accidents than the addition of new rules could possibly do. The operation of motor cars under train orders, where possible, will also do much to eliminate motor car collisions with trains. Not enough progress in this particular field of accident prevention has been made. It remains for track supervisor, roadmaster and division engineer to rid their department of this scourge. Maintenance of way men have come to regard the motor car as indispensable to their work. It well behooves them then to take the Frankenstein out of its operation and to make of every motor car not only a useful tool but more important still, an instrument of safety.

A. H. Peterson (chairman), roadmaster, C. M. St. P. & P., Chicago; M. Canavan (vice-chairman), general roadmaster, U. P., Kansas City, Mo.; C. E. Morgan, superintendent work equipment, C. M. St. P. & P., Chicago; A. W. Appelquist, roadmaster, Soo Line, Bismarck, N.D.; R. F. P. Bowman, roadmaster, C. P. R., Lethbridge, Alta.; J. P. Corcoran, supervisor, Alton, Bloomington, Ill.; L. M. Denney, supervisor, C. C. C. & St. L., Indianapolis, Ind.; C. S. McConnel, roadmaster, C. & N. W., Manitowoc, Wis.; J. M. Miller, supervisor, W. M., Cumberland, Md.; C. E. Schoenfield, roadmaster, C. B. & Q., Aurora, Ill.; R. W. Putnam, roadmaster, S. P., Oakridge, Ore.; J. A. Spurlock, roadmaster, M.-K.-T., Muskogee, Okla.; P. W. Triplett, supervisor, Pennsylvania, Chicago; E. W. Walch, roadmaster, C. & N. W., Green Bay, Wis.; M. H. Murphy, supervisor, Alton, Slater, Mo.; R. J. Yost, roadmaster, A. T. & S. F., Chillicothe, Ill.

Discussion

Opening the discussion of this report, President Haley suggested that, in view of the comprehensive character of the report, the placing of a copy in the hands of every motor car operator would accomplish a great deal in reducing the number of accidents. G. L. Sitton (Sou.) wanted to know if any better method than the use of cotter keys has been developed for holding draw-bar pins in place. Replying, Mr. Peterson said that there are a number of devices now in use for this purpose and described one which involves a snap-on principle similar to that employed in harness fastenings.

In answer to an inquiry from Mr. Sitton concerning the attitude of the committee toward the difference in elevation between the draw bars on motor cars and push cars, Mr. Peterson described the practice of his railroad which has been to standardize on the same elevation for both push cars and motor cars. On some branch lines where this has not yet been done, he said, an S-shaped coupler has been devised. C. E. Morgan (C. M. St. P. & P.) called attention to the fact that the height of motor car and push car draw bars has been standardized at 14 in. above the top of the rail by the A.R.E.A., and suggested that, in the interest of safety, this standardization should be brought about as quickly as possible.

Referring to that portion of the report dealing with the loading of tools on motor cars, A. Chinn (Alton) described two accidents that occurred because of improper loading of tools. In one of these the foreman ignored the rule which requires that track jacks be loaded on the rear ends of cars and placed a jack on the front end of the car. While the motor car was in motion the jack fell off, causing a serious accident. In the other instance a lining bar was so placed in the tool tray that one end rested on the edge of the tray at the front end of the car. Vibration of the car in motion caused the lining bar to work forward until it became unbalanced and started to fall. At this point the foreman reached down to catch it but not quickly enough to prevent the forward end of the bar from dropping between the ties. The other end, as it moved forward through an arc due to the motion of the car, caught under the arm of the foreman, flinging him forward onto the track where he was struck by the motor car and instantly killed.

Referring to the statement in the report that brake shoes faced with soft steel have the greatest braking power, Mr. Chinn wondered if aluminum is also not a good material for this purpose. H. R. Clarke (C.B. & Q.) said that it has been his experience that soft steel gives the best results and that his road has standardized on the use of this material. C. H. Ordas (C.M.St.P. & P.) explained that tests were conducted on his railroad to determine what type of material is best suited for use as the facing for brake shoes, with the result that it was decided to standardize on the use of soft commercial iron for this purpose. He contended that the material used should be readily obtainable and said that soft commercial iron fulfills this requirement. Mr. Ordas was also of the opinion that it is desirable to have at least two men on each motor car who are capable of operating it so that if the operator is disabled the car will not be delayed because of the lack of a person competent to operate it.

A. W. Wehner (S.P.), referring to that portion of the report dealing with windshields, said that his railroad has used windshields containing heavy plate glass and has experienced no difficulty with them. Supporting the recommendation in the report, Mr. Peterson contended that where windshields of glass or other transparent material are used there is danger of reduced visibility because of the frosting or soiling of the windshield. Moreover, he said, certain types of materials used for this purpose become yellowed with age, thereby resulting in a loss of transparency. Pointing to the fact that head-on collisions involving motor cars are relatively common, Mr. Morgan contended that in such cases the danger of injury is increased by the presence of glass in windshields. Furthermore, he said, there is always a "blind spot" in the windshield above the glass, thereby creating an additional hazard. Mr. Morgan also described tests which have been conducted on his railroad to determine the angle at which wind is reflected from vertical and slanting surfaces.

Mr. Chinn also agreed with the stand taken by the committee in regard to windshields. Years ago, he said, the practice on his road was for the foremen to supply their own windshields, with the result that accidents occurred because of reduced visibility. To correct this situation windshields of the type recommended in the report were installed and further trouble has been avoided.

C. W. Baldridge (A.T. & S.F.) took exception to the recommendation in the report and contended that the use of shatterproof glass in windshields would involve no danger. He said that a large clear opening in the

windshield provides a maximum of visibility and disagreed with the statement that wind is deflected upwards at a sufficient angle to permit a man to see over the top of a windshield without interference from the wind. A strong flow of cold air, he contended, will make anybody's eyes water, thereby interfering with their ability to see clearly. The hazard thereby created, he said, is greater than that presented by the use of glass in the windshield.

T. F. Donahoe (B. & O), referring to the present practice of equipping motor cars with rail skids, suggested that such skids be placed about three inches inside of the rail so that if the car becomes derailed it will ride on the skids and not tend to turn sidewise. He also recommended the use of steel brushes for rail sweeps. Mr. Peterson explained that there is some question as to whether sweeps should be used. For instance, he said, if there is a light coating of snow over the rails the sweeps on the motor car may brush torpedos from the rail without the knowledge of the motor car operator, thereby creating a serious hazard for trains.

The Maintenance of Rail Joints

Report of Committee

G. L. Sitton
Chairman

THE maintenance of rail joints is one of the trackman's major problems, for although joint bars themselves extend over only about 7 per cent of the length of a railroad, nearer 70 per cent of all work done on track affects the rail joints, either directly or indirectly. As the maintenance of rail joints is affected so greatly by their design, manufacture and application, we will discuss these three subjects, in order, before discussing maintenance itself. Before starting our discussion, however, we would like to emphasize, as applying to all classes of work to be discussed, the fact that quality of workmanship is of great importance and should be given preference over quantity.

Design

The first requirement in connection with the design of a rail joint is that it shall fit the rail, so that the design of the rail directly affects the design of the joint. Some of the older sections of rail are of such shape as to impose severe restrictions on the design of the joint, due primarily to the limited distance between the base and head of the rail. This feature has been well considered in the most recent designs of rail sections, however, so that with these sections, it is much easier to design a strong joint.

The general use of 39-ft. instead of 33-ft. rails has appreciably reduced the expense of joint maintenance, as has also the use of 60-ft., 66-ft. and 78-ft. rails through tunnels, crossings, station platforms, etc. There has been a limited use of these longer rail lengths in regular track work, and it is likely that, if equipment becomes available for transporting rails longer than 39 ft., without the use of two cars per rail length, the general length of rails will be increased from 39 ft. to 45 ft. or possibly more. The problem of expansion allowance in rails as long as 78 ft. does not seem to present any serious difficulty, especially in rails of the heavier sections, which do not absorb as much heat as lighter rails.

A very desirable feature in rail joint design is that the wave motion of the rail under traffic shall pass through the joint just as it does through the balance of the rail. With such a joint there is no necessity for spacing joint ties. The present tendency in design is in this direction, but the desired end has not yet been realized.

An important advance in joint design has been the toeless bar without joint spikes, for use with the heavier rail sections. The use of such joints, of course, requires that anchorage be provided by other means than by slot spiking. This not only relieves joints and bolts from anchorage stresses, but is easier on joint ties as they are not moved back and forth with the rail, and therefore remain solidly tamped longer.

Some joints are so designed as to provide bearing under the rail head at and near the end of the rail, and on top of the base of the rail at and near the ends of the joint. Some joints of this general design are capable of offering little resistance to upward bending stresses, while others offer resistance to both upward and downward bending stresses. One advantage of joints of this type is their ability to fit closely under the head of the rail after considerable wear has taken place in both rail and joint. This is, perhaps, the greatest single objection to joint bars of uniform section, the bars, especially for the heavier rails, being so stiff laterally that they will not bend to compensate for wear, with the result that, when they are worn appreciably, some other means than tightening the bolts must be resorted to in order to produce a tight joint.

The head-free type of joint has come into quite extensive use. Perhaps its principal advantage is its ease of application, there being no danger of cocking.

The question of the proper length of joint bars, and whether four-hole or six-hole bars are more economical, is one on which there is quite a division of opinion. We believe that the majority of joints are of the four-hole type but it is entirely possible that this is attributable to their lower first cost, and not to ultimate economy.

In the "What's-the-Answer" department of *Railway Engineering and Maintenance* for December, 1936, Armstrong Chinn, chief engineer of the Alton, had the following to say on this subject: "Since a properly designed joint should have the same wave action or flexure as the rail, its length should be proportional to its height, so that its beam action will be about the same as that of the rail. In other words, its length should be governed by its height, and therefore by the weight of the rail. Obviously a 36-in. joint bar is unnecessary on

a 60-lb. rail while a 24-in. bar on a 131-lb. rail would be so short and stiff that four bolts could scarcely hold it in place for proper flexure. For these reasons four-bolt joints will probably be entirely satisfactory on rail weighing 100 lb. or less, while heavier rails, because of their greater height, will do better with six-bolt joints." The above quotation seems to cover this question admirably.

Another item under the heading of design is the use of rails with mitered heads and square cut bases. This practice is in the experimental stage at present, but information of value should be obtainable in another year or two.

Manufacture

Here, again, the effect on the maintenance of joints goes back to the manufacture of the rail itself. The less the variation in shape between individual rails, the less will be the expense of joint maintenance, because lack of uniformity causes wear to start sooner, due to the uneven fit of the joint bars to the rail.

A recent notable advance in rail manufacture is the practice of end-hardening the rails at the mills. It is believed that most rail now manufactured is so hardened. This will undoubtedly result in great savings in joint maintenance, and in rail maintenance as well. The ends of the rails should be chamfered about 1/16-in. on top, so that compressive stresses due to high temperatures may be carried below the top portion of the head of the rail, and the danger of chipping be eliminated.

Improvements in rail manufacture which result in fewer rail failures exert an influence on joint maintenance, as it is practically impossible to patch in a rail that will fit all conditions as well as the rail which was removed. The processes of controlled cooling and normalizing will, therefore, prove of some benefit in connection with our problem.

The above reference to variation in the shape of individual rails also holds good for joint bars. These bars should be uniform in cross-section, should be free from any distortion caused by shearing, should be straight and not twisted.

Application

No matter how well a joint is designed and manufactured, it will not give its best service unless it is properly applied.

Assuming that joints are applied when rail is laid, it is believed that it will be helpful to observe the following:

(a) The adzing of ties, by machine, to provide flat, level seats for tie plates will reduce joint maintenance by eliminating twisting stresses, and by reducing the rate at which joint plates bed themselves in the ties.

(b) Proper attention to expansion allowance when laying rail will reduce joint maintenance. With the heavier rail sections, with chamfered ends, less expansion allowance is needed, but sufficient anchorage is important.

(c) The fishing surfaces of rail and the inside surfaces of joint bars should be protected before laying with a good coat of heavy metal preservative, and bolts should be dipped in a protective lubricating material such as crater compound. These precautions will reduce the rate of corrosion and extend the life of the parts. They will also facilitate the proper application of the joint bars, and will help prevent the occurrence of frozen joints.

(d) Care should be taken to insure against the cocking of joint bars during their application, as improper

Quenching a Rail End—A Step in Heat Treating, a Practice That Is Growing in Favor on the Railroads

fit resulting from cocked bars does not result in the best service. Bolts should be heat treated.

(e) Bolts should be tightened promptly; if possible, before traffic is allowed over the new rail, and there should be several follow-up tightenings as the bars seat themselves. This work can be done better and more economically by machines designed to tighten all bolts to a uniform, pre-determined tension.

(f) The use of spring washers of sufficient strength to act as shock absorbers, and to compensate for a slight amount of wear is essential. Any device used for the above purposes should be designed to be used in connection with bolt-tightening machines. The experience of members of the committee is that some designs will fail when bolts are tightened by machine.

(g) Proper anchorage is very important. Anchors should be applied as soon as rail is laid, before any

The Building Up of Battered Rail Ends Is a Widely Recognized Means for Extending the Life of Rail

traffic is allowed over it. It is foolish to take care to lay a rail exactly where it belongs, and then not keep it there.

(h) It hardly seems necessary to mention the fact that all rail joints should be provided with tie plates or abrasion plates; yet there are many miles of track carrying considerable traffic where such plates are not in use.

(i) Rail end batter, in new rail, frequently progresses rapidly due to minor differences in the height of the heads of adjoining rails. These slight differences can be overcome by grinding down the high rail to the level of the low rail, preferably with a reciprocating grinder.

(j) Where new rail is not end-hardened and chamfered at the mill, this work should be done in the field soon after the rail is laid. It can be done by either the oxy-acetylene or the electric process. Even if the rail is not end hardened, it should be chamfered, preferably by the use of a cross grinder, because this aids materially in reducing the rate of batter as it prevents fins of metal from rolling over from one rail on top of the other, and later chipping out.

(k) In most cases track should be surfaced soon after rail is laid. This not only serves to prevent damage to the rail but helps reduce the cost of future joint maintenance. Good tamping and good drainage are im-

portant. Better tamping can be obtained by using tamping machines.

Maintenance may be divided between ordinary maintenance and rehabilitation.

(a) Probably no feature of ordinary maintenance is more important than keeping bolts properly tightened. The wear of parts in contact with each other progresses much more slowly where bolts are tight. Once wear has a good start, it is hard to stop, and the result is a condition where it is almost impossible to maintain the joint properly.

A Number of Roads Are Building up Joint Bars to Overcome Wear on Rail and Bar

The use of bolt-tightening machines will undoubtedly prove of great benefit to track men in their efforts to maintain tight bolts. These machines are designed to produce a reasonable degree of uniformity in bolt tension. Bolts should not be tightened sufficiently to result in frozen joints.

Machine Adjustment

The problem of adjusting machines so as to produce sufficiently tight bolts, and at the same time not get them tight enough to result in frozen joints, requires very careful study and handling. It is very easy to get bolts so tight in ordinary track construction that buckling track will result. When bolts are tightened in cold weather it is more than ordinarily necessary that they not be tightened sufficiently to result in frozen joints. The better the anchorage of the track, the less the likelihood of trouble from frozen joints, though track that is well anchored may cause trouble if it is surfaced and not promptly filled in with ballast. The most prevalent practice in tightening bolts by machine seems to be to tighten them once a year, the machine being used for this purpose when not required in connection with laying rail.

(b) Corrosion due to brine drippings is a source of much trouble on many railroads. The metal in the joints and fastenings, as well as the rail itself, can be protected by oiling with a metal preservative. Where it is desired to oil the entire length of the rail, this work can be done most economically by machine. Small portable sprayers serve well to spray oil between the joint bars and the rail. Whenever joints are applied in ordinary maintenance all parts should be protected, as referred to in the discussion on the application of joints. Joints should preferably be oiled twice each year, though local conditions should, of course, govern.

(c) A joint cannot be maintained properly unles it is supported on a sufficiently thick bed of clean ballast that gives good drainage.

(d) The rail joint is universally recognized as the weakest point in the track structure. Because of the gap at the rail ends it is subjected to more pounding than any other portion of the rail. For these reasons joints require better tamping than track elsewhere. Joint ties under the receiving end of a rail need firmer tamping than under the leaving end as they have to withstand the impact resulting from the gap between the rail ends.

Power Tampers Reduce Costs

The introduction of power tampers has been helpful in reducing costs of joint maintenance. Spot tampers are especially helpful for tamping at joints where the track does not need a general surfacing. Machine tamping produces more uniformly and more solidly tamped track than hand tamping, with the result that the track retains its surface longer.

(e) Where traffic is in one direction, most of the wear at the points of contact of joint bars and rails occurs at the receiving end of the rail, and, therefore, at the leaving end of the joint. Conditions can frequently be improved by reversing the joint bars so as to place the unworn ends of the bars in contact with the worn ends of the rails, and vice versa. Many joints which cannot be tightened on one end may be reasonably tight after reversing the joint bars. When this work is done, the rail ends and the inner surfaces of the joint bars should be thoroughly cleaned and oiled.

(f) Roadbed of proper height and width and its proper drainage results in less expense for joint maintenance.

Eventually joints become so badly worn that it is no longer possible to restore them to good line and surface and sufficient tightness without more extensive work than is usually considered ordinary maintenance. This usually embraces the following:

(a) Restoring battered rail ends by either the electric or gas welding process. This work can produce rail ends almost equivalent to new rail ends, and because the metal applied by welding is harder than the original rail, subsequent batter will usually be much slower. Where work of this kind is to be performed, joint ties, where loose, should be solidly tamped, and joints should be thoroughly tightened before the actual building up of the rail ends is undertaken. In connection with the work of building up battered rail ends it is practicable to heat-treat the rail ends and thereby reduce the rate of future batter.

(b) While it is comparatively easy to restore the running surface at the end of a rail, the problem of overcoming the effects of wear where rail and joint bars come in contact with each other, is quite another matter. Perhaps the simplest and cheapest thing to do is to apply shims between the joint bars and the rail. This method is extensively used by a number of railroads with good results. The shim in most general use is a tapered shim which fits between the top of the joint bar and the lower side of the rail head, the taper being approximately the same as that resulting from wear. The use of shims is not considered a perfect remedy for this trouble, however, as it is not easy to keep shims from breaking and working out of place, due largely to unequal wear on opposite sides of the joint gap. This is especially true on important tracks where very thin shims are required owing to the necessity for improving conditions before they become bad enough to permit the use of thicker shims.

Shims of designs other than the tapered shims above referred to are on the market but we have no information as yet as to their performance. It is difficult to imagine how a shim of uniform section can compensate successfully for wear which is not uniform.

Applying New Joint Bars

(c) Another method of improving conditions due to wear at joints is by applying new joint bars. This method compensates entirely, of course, for the wear on the joint bars, but it does not compensate at all for wear

on the rail, and is, therefore, not considered an entirely satisfactory solution of this problem.

(d) Still another method of rail joint rehabilitation is by the use of reformed bars, which method consists of heating bars to forging temperature and pressing them to the desired shape. By this method bars may be reformed to compensate for wear and may be crowned at the middle where the wear of both the joint bars and the rail, is greatest. In determining the amount of crown to be pressed into bars when reformed, a study of the average wear of rail and bars where the reformed bars are to be used, is necessary, and the bars are reformed to fit this average condition. This prevents an exact fit, therefore, where wear is greater or less than the average, or where there is more wear on one side of the joint gap than the other. This method is quite effective, however, except where the wear at individual joints varies considerably from the average, and, more especially, where traffic is in one direction and there is considerable difference in wear under the heads of abutting rails.

In connection with the reforming process, joint bars may be heat treated.

(e) Another method is to build up the top surfaces of worn joint bars by welding. By this method the bars can be crowned at the middle so that the shape of the built-up bar is such as to fit the average of the worn rails very closely. This method is fairly inexpensive, costing as low as 16 cents per joint bar, exclusive of the cost of exchanging old bars for those which have been built up. As this type of work is usualy performed on the division where the joint bars are to be used, it is easy to crown them to fit closely the worn rail to which they are to be applied.

In connection with the use of either of the four methods just described, fishing surfaces of rail and joint bars should be thoroughly cleaned and oiled, and bolts should be dipped in heavy grease before being re-applied. If bolts are badly corroded, new bolts should be used.

Sawing Off the Rail Ends

(f) Eventually the time will come when none of the methods described will meet the situation satisfactorily, and nothing remains but to remove the rail from the track, saw off the worn ends, and relay it, using new joints. This method is expensive, and for this reason maintenance men postpone it as long as practicable. It does offer, however, a real solution to the problem, for, if the fishing section of the rail has been protected from corrosion, the bearing surfaces offered for contact by joint bars will be as good as new. Before deciding to follow this method, however, good judgment should be used in determining whether the rail in question is worth the expense or whether it is so badly worn throughout its length that it should be relegated to side track use, or scrapped. There is, of course, plenty of side track mileage where the traffic is sufficiently heavy to justify the use of rails with sawed off ends and new joints. An objection to this method is the increase in the number of joints per mile.

One Railroad Uses This Machine for Oiling Track Joints to Overcome Corrosion

Butt-Welding Joints

While is is recognized that joints that are eliminated do not require maintenance, no discussion of the maintenance of rail joints would be complete without reference to this very important subject.

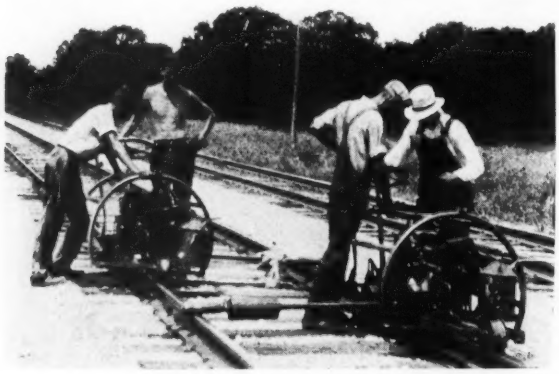
There are two separate purposes behind the butt-welding of rails, namely: the elimination of joints which are difficult to maintain, such as in street and highway crossings, passenger landings, tunnels, etc., and the continuous welding of rail for the purpose of eliminating all except insulated joints. The practice of butt-welding rails in crossings, tunnels, and passenger landings has been in effect for a number of years and a number of fairly long stretches of track in streets have been continuously welded for some time. This work has, generally, been successful. The welding has been performed by gas, electric and Thermit welding. In the cases of gas and electric welding it has sometimes been the practice to replace the joint bars, as insurance against failures at or near the welds, although the joint bars sometimes have been left off. In the case of Thermit welding, the joint bars are never replaced.

In order to prove entirely successful butt welds should be as strong as the rail, and the welding operation should not cause any damage to the rail which would cause it to fail near the weld. It is believed that comparatively little butt-welding work which has been done in the past has been capable of meeting these requirements, though it is believed that this problem will be solved in the near future. Perhaps a high percentage of the failures of butt welds which have occurred in crossings, tunnels, etc., have been due to welding together worn and corroded rails which should have been replaced with new, or practically new, rails before the welding was done. There is undoubtedly quite a field for butt-welding in crossings, tunnels, passenger landings, etc., even though the welds may not be quite as strong as the rails, because it is always possible, except with Thermit welds, to replace the joint bars as insurance against trouble in case of a weld failure. Joint bars used for such purpose need not be new, or even good relay bars, as they have nothing to do unless a weld fails, and in the case of such a failure, a badly worn joint will serve until other arrangements can be made.

A Different Problem

The continuous welding of long stretches of track, for the purpose of eliminating joints, is quite a different problem from that of eliminating individual joints, or limited numbers of joints in crossings, tunnels, etc. In this case, in order to prove successful the welds must be as strong as the rail, and there must be no damage to the adjoining metal in the rails. Notable installations of continuous welding have been made by the Delaware & Hudson and by the Bessemer & Lake Erie. All track men are deeply interested in these installations, which have been described in articles in the January, 1935, and February and June, 1936, issues of *Railway Engineering and Maintenance*.

It is natural that one of the trackman's first thoughts in connection with the continuous welding of rail is how expansion is taken care of. It seems to have been proven conclusively that either M & L or GEO track construction provides sufficient anchorage so that, with heavy rail and heavy ballast sections, no trouble may be expected due to expansion so long as the welding work is performed during hot or warm weather, and especially as long as the track is not surfaced. We are not yet convinced, however, that this class of work can be undertaken during cold weather, without trouble due to buckling track if the track is surfaced in hot weather. We do know, from experience, that ordinary track construction, with cut spikes and, say, eight rail anchors per rail, will buckle if surfaced in hot weather, unless the proper provision is made for expansion.



Tight Bolts are Essential to Joint Maintenance. Machine Tightening Is Both Economical and Efficient

This fact is so well established in the minds of track men that we are inclined to view with skepticism any claim that rail can be continuously welded in cold weather and surfaced in hot weather, without causing trouble. We await with interest, therefore, the result of attempting to surface, in hot weather, track where the rails were continuously welded in cold weather. Hopeful though we may be on this point, we must not let our hopes get the best of our judgment as there has been no change in the coefficient of expansion of steel. If rail does not expand when the temperature rises, something has to prevent such expansion. While it is possible, by anchoring the rail firmly to each tie, to hold the track in place in a heavy bed of ballast, it is difficult to imagine what is going to hold it when it is jacked up in hot weather. We, therefore, reserve our decision on this important point, and advise caution.

As contrasted to the question of expansion, there is also the fact to be considered that rail welded together in very hot weather may develop tensile stresses, during very cold weather, amounting to almost 20,000 lb. per sq. in. Any such stress may increase materially the number of broken rails in cold weather.

The type of welding used in most cases of continuous welding has been a combination of a Thermit fusion weld on the base and lower part of the web and a pressure weld, using heat generated by the Thermit reaction, on the head and upper part of the web of the rail. The flash weld method, which employs an electrical current of very high amperage, is also being developed. It appears that both of these methods will prove successful, but it is too early to predict which will be the better.

Committee—G. L. Sitton (chairman), chief engineer maintenance of way and structures, Sou., Charlotte, N.C.; F. B. LaFleur (vice-chairman), roadmaster, S.P., Lafayette, La.; G. E. Boyd, associate editor, *Railway Engineering and Maintenance*, Chicago; Armstrong Chinn, chief engineer, Alton, Chicago; W. Constance, supervisor reclamation, C. & O., Barboursville, W. Va.; R. W. Grigg, supervisor, Penna., Orrville, Ohio; M. Donahoe, division engineer, Alton, Bloomington, Ill.; G. W. Hammonds, roadmaster, M.P., Kinder, La.; J. B. Kelly, general roadmaster, M. St. P. & S.S.M., Minneapolis, Minn.; H. P. Mason, supervisor, B. & M., Boston, Mass.; O. R. McIlhenny, roadmaster, T.C.I. & R.R., Birmingham, Ala.; P. F. Muller, roadmaster, C. & W.I., Chicago; D. V. O'Connell, roadmaster, C. & N.W., Chicago; I. D. Talmadge, roadmaster, N.Y.O. & W., Middletown, N.Y.; A. H. Wehner, roadmaster, S.P., Lake Charles, La.; W. H. Haggerty, supv., N.Y.N.H. & H., New Rochelle, N.Y.

Discussion

Discussion of the report centered largely around the advisability of chamfering the ends of new or built-up rail and the controlling of expansion and contraction of rail in track. R. W. Putman (S.P.) questioned the recommendation concerning the chamfering of rail ends, pointing out that the increased width of the resulting gap caused increased wheel impact on the receiving rail, with greater tendency to batter.

Chairman Sitton admitted that the gap was increased by chamfering, but contended that without chamfering, the rail head metal was pushed or rolled out into the expansion gap where it offered little resistance to chipping out, which often extended well back into the rail. His experience, he said, showed that by chamfering the ends, there was a minimum tendency for the metal to flow into the gaps, with subsequent chipping.

Supporting Mr. Putnam, J. E. Willoughby (A.C.L.) said that with the new end-hardened rail, with its greater resistance to flow under traffic, he could see no value in chamfering, but a disadvantage from increasing the width of gap at joints. C. W. Baldridge (A.T. & S.F.) raised the question of when the cross cutting or chamfering of rail ends should be done, and expressed the opinion that this work should be carried out immediately following the laying of the rail. A. A. Miller (M.P.) said that new rail was chamfered on the Missouri Pacific, and that it is the practice to delay this work for about two months after the rail is laid.

Laying Rail Tight

Concerning the tendency to reduce the amount of expansion space at rail joints, and the results which may be expected therefrom, Mr. Miller told of an installation of GEO track on his road in which the rail had been laid tight during November, and of a second installation of the same type of track in which the normal expansion gap had been cut in half. Both installations are in territories with bad subsoil conditions, and in open track, except for a part of one located in a tunnel. In spite of this situation, and the fact that both pieces of track have been skeletonized, raised and reballasted, he said that no trouble had been experienced with buckling. Where the rail is held firmly at each tie, as in GEO construction, he said, one should have little fear of expansion.

Elmer T. Howson *(Railway Engineering and Maintenance)* commented upon the important and widespread changes which have been made in track construction and maintenance practices in recent years, and said that the report showed clearly that track construction and maintenance methods were keeping well abreast of improvements in passenger and freight equipment and service.

As an indication of the constant and rapidly changing situation in the track

field, Chairman Sitton pointed out that new developments since the draft of the committee's report already required that the report be changed or modified in several respects. As an example, he called attention to the fact that contrary to a statement in the report, there are now available new oversize, deformed joint bars which not only provide an enlarged section of bar for use with old rail, but which also compensate for the maximum wear in the bar contact surfaces of such rail.

J. O. Surprenant (D. & H.), interjecting consideration of continuous welded rail into the discussion, told of the experience of his road with a large amount of such rail. He said that welded track offers a complete solution of the rail joint problem, and that he expected to see largely increased use of this type of track construction in the future.

The Housing of Track Labor

Report of Committee

J. A. Turner
Chairman

THE problem of housing track labor has confronted the railways of the United States and Canada since their beginning, although the character and scope of this problem have varied with different periods in the history of individual roads and with changing conditions on different parts of individual roads. In the early days of the railways, and, more particularly, during the period of their rapid expansion into undeveloped, sparsely settled sections of the country, it was essential that they provide housing facilities for their track construction forces. For many years after this period, and largely for the same reasons, it became essential that many roads provide facilities in which to house their track maintenance forces as a necessary inducement to hold men on the work.

In later years, with the growth of communities along the lines of the railways and the establishment of regular section organizations, with definitely confined territories and steady work, company housing assumed smaller proportions on many roads, but again during and immediately following the World War, the competition for labor offered by industry through higher wages than those paid on the railways, again made it necessary to re-establish many maintenance of way labor camps in order to secure and hold men. Later, this situation largely adjusted itself and many camps were closed, but throughout, and to the present time, it has been found necessary or advisable under certain conditions for most railways to house at least a part of their track forces. As a matter of fact, in recent years, the desirability or necessity for company housing facilities has again increased.

Present Reasons for Housing

The considerations which still bring about the housing of a part of the track labor on the railways are largely similar to those of the past, and may be enumerated as follows: The lack of available private housing facilities in sparsely settled sections of the country; the use, of necessity, for a large amount of seasonal work, of transient labor, which has no hometies or means of housing; the use of foreign or colored labor in some sections of the country, away from its natural environment or surroundings, for which it is difficult, and often impossible, to secure local housing accommodations; the necessity in times of general or local labor shortages, due to industrial, agricultural or other competition, for the added inducement to employment afforded to a certain class of men by company housing facilities; and the desirability in many cases, especially within or about large terminals or on lines carrying heavy traffic, of keeping sizeable forces intact and readily available for emergency work. To these, however, has been added in recent years the important factor of changed practices in carrying out maintenance of way work, involving mechanized extra or floating gangs engaged in division, regional or system programs of specialized work, and moving from point to point as the work progresses.

Any one or all of these factors may have a bearing upon the necessity for or the desirability of housing track labor, and may more than justify the cost and the added thought and supervision which are involved. Even where none of the above considerations, in itself, makes it essential to house track forces, some roads continue to house a part of their men, and in the practice feel more than justified through the greater availability of the men and the higher quality of men normally attracted to floating gang operations by suitable company housing facilities; the increased efficiency of forces maintained intact through the company camps; the greater contentment among the men which suitable company housing insures; the frequent large saving in the cost of travel time of the men to and from work, especially in the case of camp car outfits and other portable housing facilities; and the added element of safety in having regular employees close at hand during off-duty hours, where they can observe passing trains for damaged or defective equipment, and otherwise keep an eye on the railroad property.

Trend Toward Improved Facilities

The facilities provided for housing track labor can be divided into two general classifications—permanent or portable camp buildings, and camp car outfits equipped for road movement from place to place at frequent intervals as routine or special work may require. The character and extent of these facilities on different roads depend upon a number of considerations, including the class of work being carried out, the permanence of the need for the facilities, the size of the force to be housed, and climatic conditions. In many cases, the character and extent of the facilities afforded have been influenced to some extent by the general living standards of the employees to be housed, or by competing labor conditions, but, in general, it may be said

that there has been consistent endeavor on the part of the railways to maintain under all circumstances a reasonably desirable and satisfactory standard of living conditions among the employees housed in their maintenance of way camps.

With the changes in maintenance of way methods and general working conditions which have been brought about in recent years on many roads, involving mechanized operations by

Clean and Attractive Dining Cars Aid in Holding Men

specialized gangs moving over large territories, and the desirability in this connection of securing and holding the highest class of labor available, combined with greater appreciation of the increased efficiency of employees living close to the work under comfortable conditions, the trend toward better and more thoroughly equipped housing facilities has been very noticeable. This trend, which began as much as 10 or 15 years ago, became pronounced in the late Twenties, and has continued to the present time, each new installation of housing facilities showing the influence of this trend.

The various types of camp buildings ordinarily provided for both permanent and portable camps include bunk houses, mess halls, lounging or recreation buildings and wash and toilet buildings, although for small groups these various facilities may be provided in one or more buildings. Frequently, in addition to the above units, it has been found desirable to provide a small outlying building, sometimes called an isolation building, for any members of the force who may become sick, or who, for any other reason, should be housed temporarily apart from the remainder of the group.

Permanent camp buildings are generally built of timber, although many have been built of other materials, including concrete, concrete blocks, hollow tile and corrugated sheet metal over a steel or wood frame. The roofs, usually of small span, are generally of frame construction, covered with roll-type roofing, and the floors are usually of timber.

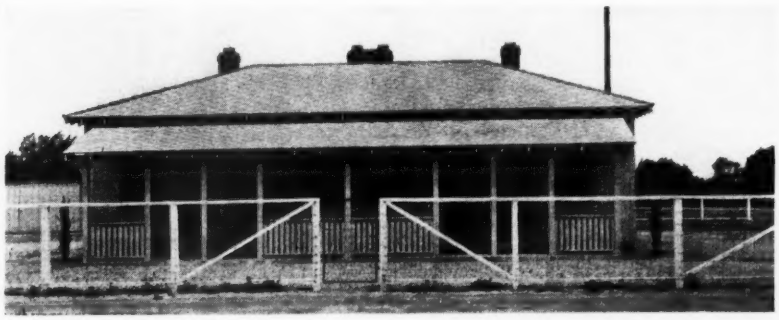
Temporary maintenance camp buildings are usually of the sectional type, of wood or sheet metal construction, capable of being erected readily, and of being dismantled for transportation on cars to a new location. Joined largely by bolts, these units usually have metal or timber roofs, and timber floors.

Camp car outfits provide sleeping, dining, kitchen and commissary quarters, and usually separate living quarters for the foreman and lounging or recreation space for the men. For use under varying conditions, these facilities are often combined in different arrangements. Some sleeping cars are arranged for sleeping only, while other sleeping car arrangements provide a lounge or recreation space at one end. Dining and kitchen facilities are often combined in a single car, but for large gangs frequently occupy separate cars. In some cases, kitchen and commissary facilities are combined in one car, while in other cases dining and commissary facilities are combined. Separate foreman quarters are usually combined with dining, kitchen, commissary or recreation areas as seems most desirable, but on some roads, an entire car, providing living and office quarters, bedrooms and a bathroom, have been provided for the joint use of a foreman and his assistants.

Wash and toilet facilities in many camp car outfits are provided in each sleeping car, but where large gangs are housed, many roads have found it desirable to combine all of these facilities for the entire gang in a separate wash car, or in a car used in part for recreation purposes. Most camp car outfits now afford some recreation area, the size of this area depending to a large extent upon the size of the gang housed.

For many years, and continuing to the present time, converted box cars have been used for camp cars, although there has been a distinct trend in recent years toward the use of retired passenger train cars, when available, for camp service. Many roads have converted old passenger coaches into camp sleeping, dining and recreation cars, and a number of roads have also converted old passenger dining cars and express and baggage cars into various types of camp cars. Old refrigerator cars have also been found highly suited for some types of camp cars to be used in cold climates.

The committee in its study of this subject has made no attempt to design permanent or portable camp housing facilities, or the layout of the different units of camp car equipment. The Committee on Economics of Railway Labor of the American Railway Engineering Association has on several occasions given special consideration to this phase of the subject, and we call attention to the results of its work, presented to the association in 1919, and again in 1934. With its report of 1919, published in Volume 20 of the Proceedings of the association, the committee submitted a number of plans for permanent and semi-permanent camps, which were subsequently approved by the Building committee of the association, and which have not been revised to date.



Many Roads Are Constructing Attractive Dwellings for Their Trackmen

Separate plans were submitted for the following buildings in both permanent and portable camps: Commissary store, isolation building, mess hall, bunk houses, lounging buildings, and a wash and toilet building. In addition, a plan was submitted for a septic closet for use at either permanent or portable camps. In submitting these plans, it was pointed out that they were intended merely to give a general idea of the type and arrangement of buildings most suitable for the purposes intended, and that no attempt was made to present on the plans details of construction, which

were left to the discretion of individual roads.

In the same report, the committee presented floor plans for several types of camp cars, but for its latest work in this regard, we refer to its report made in 1934, at which time it presented revised plans for camp cars adapted from both freight and passenger equipment. These plans, which were adopted by the association, and which are printed in its Manual of Recommended Practice, include plans for the following cars made from box cars: A foreman car, affording a living room, two bedrooms and a bath; a kitchen car, affording a kitchen and a cook's room; a dining car, which is used exclusively for dining purposes; a recreation car, which provides a lounge and a wash and toilet room for an entire gang, with three shower baths; and a sleeping car, with double bunks and lockers for 16 men.

The plans for various camp car units adapted from passenger train cars include the following: A combination kitchen and dining car, the dining room occupying approximately one-half of the car and seating 22 men; a combination recreation and bathroom car, the bathroom including toilets, lockers, lavatories and four shower baths; a sleeping car, with 12 bunks separated into groups of 6 at each end by means of a locker, dressing and heating compartment; and a typical water and fuel car. These plans were prepared in such manner that they might be readily adapted by the various railways to suit the required standard of living of the men to be housed, the size of the gang, type of work, and other considerations which might prevail.

Articles Recommended

To those making a study of camp cars, we recommend for review, in addition to the A.R.E.A. plans already referred to, certain articles dealing with this subject which have been published in *Railway Engineering & Maintenance*. One of these, appearing in the issue of May, 1929, presents a survey of the practices in the make-up and details of camp cars on 40 railroads in the United States, comprising 133,500 miles of line, as well as the two major Canadian systems, with a total of more than 35,000 miles. Other articles include one describing the camp car facilities on the Kansas City Southern and on the Delaware & Hudson, which appeared in the issue of June, 1929, a second article on camp trains on the Pennsylvania, which appeared in the issue of May, 1932, and a third article describing the conversion of passenger train cars into camp cars on the Chesapeake & Ohio, which appeared in the issue of September, 1936. Much of interest bearing on this subject will also be found in a report entitled Camp Cars and Their Equipment for Bridge and Building Crews, presented before the fortieth annual convention of the American Railway Bridge and Building Association in 1930, and published in the Proceedings of the association for that year.

Features Warranting Consideration in Buildings

The committee, beyond bringing to the attention of the association the foregoing references to indicate the wide range of flexibility in camp and camp car facilities to meet varying conditions, makes no recommendations concerning the general layout of these facilities. However, it calls attention to a number of features of design, furnishing and maintenance of both camp buildings and camp cars which are being more generally accepted, and which are worthy of consideration. The items immediately following pertain to camp buildings.

Permanent and temporary camp buildings should be located on property adjoining the tracks, and as near as possible to the center of the working territory, in order to save travel time.

The type of construction employed should be appropriate to the climatic conditions prevailing, and the effect of appearance on both the men and on the public in passing trains should not be overlooked.

Camp buildings, and especially sleeping units, should avoid overcrowding of the men, and should be provided with adequate windows and roof ventilators. All doors and windows should be provided with screens.

The toilet facilities, regardless of the size of the camp, should be housed in a unit apart from the other facilities, and should conform with local ordinances or requirements, or be of an approved sanitary type. Shower baths, supplied with both hot and cold water, should be provided where possible.

Sleeping bunks should preferably be of steel construction, with springs and mattresses, and a clothes locker, preferably, all-steel, should be provided for each man.

All buildings, where possible, should be wired for and fitted with electric lights.

All buildings should be maintained in a clean, safe and sanitary condition, and should be fumigated at intervals to insure that they are kept free from germs, insects and rodents.

Features of Car Design

The following are features of camp car design, furnishings and maintenance which are worthy of consideration:

Camp cars should be maintained in good general condition and suitable for operation over the road in either work trains or regular freight trains. Draft gear and draft-gear attachments, and all safety appliances, should be maintained in good order.

Box cars converted into camp cars should be lined, sides and ends, with matched lumber, or equally serviceable material, and where floors are not in good condition, or where the cars will be in service under cold weather conditions, the original car floors should be covered with matched flooring or equally suitable material.

Adequate windows should be provided in sleeping, dining and kitchen cars, preferably with movable upper and lower sash. The windows should be fitted with roller blinds to assist in keeping the cars cool during the summer, and all windows, as well as doors, should be provided with screens. Sufficient roof ventilators should be provided to afford adequate ventilation when the car windows must be kept closed because of weather conditions.

Overcrowding in sleeping cars should be avoided. Comfortable single or double-deck bunks, preferably

Passenger Equipment Is Better Lighted and More Easily Kept in Sanitary Condition

of all-steel construction, with springs and mattresses, should be provided, and a clothes locker, preferably all-steel, should be provided for each man.

In connection with the wash and toilet facilities provided, whether within sleeping cars or forming a part of other cars, shower baths should be given consideration, as well as lavatories, and both should be piped with cold and hot water. Inside toilets should preferably be of the chemical type, and, in any event, care should be taken to dispose of waste matter at proper intervals and in a sanitary manner. Outside portable toilets of an approved type should be provided for certain types and size of gangs where camps are held at locations for any appreciable period of time.

Sufficient lounging area should be provided, either in sleeping cars or in a special recreation car to afford space for the men to read or to otherwise amuse themselves in their leisure time, and adequate seating and lighting facilities should be provided in this area.

All living cars should be wired for and fitted with electric lights, in addition to being provided with oil lamps, and should be equipped with a plug-type extension for use when within reach of a power supply at a station or terminal.

Where climatic conditions require, in addition to the usual heating stoves furnished, consideration should be given to wall, floor and ceiling insulation, ranging from building paper to some form of insulating board.

One or more cars in the camp, preferably the recreation car and the dining car, should be provided with a water cooler.

All cars should be fitted up and furnished with an aim toward cleanliness and sanitation. Interiors should preferably be painted a relatively light color above a dark dado. The cars should be fumigated at intervals to insure that they are kept free of germs, insects and rodents.

Of Late Passenger Cars Are Being Used for Traveling Camps

Advantages in Company Housing

The advantages to be derived through the proper housing of labor forces depend to a large extent upon the circumstances under which the housing is done, but, in general, they may be, in whole or in part, as follows:

Permit the organization and maintenance of large mobile gangs for specialized work, with minimum deflections from service.

Meet the need brought about by inadequate housing facilities along the line.

Present a valuable inducement to employment during labor shortages.

Generally attract a higher class of labor and reduce labor turnover, both of which affect favorably the efficiency of work organizations.

Add to the general welfare of employees who cannot find or afford equally satisfactory housing facilities.

Reduce the expense to the railroad for travel time of the men to and from the scene of work operation, and through the saving in loss of travel time, permit greater daily production.

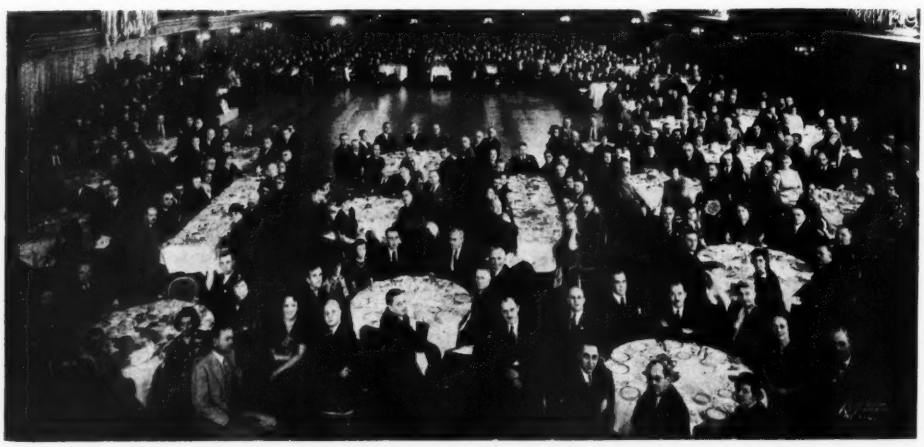
Make available large groups of men, on minimum notice, for the conduct of emergency work.

Tend to promote the safety of train operation and the protection of company property through the watchfulness of those employees about the railway when off duty.

Off-setting these possible advantages are the cost of providing and maintaining company housing facilities, and the added responsibility that is placed upon the supervisory officers for their general supervision and upkeep.

Conclusions

Study of the subject in question, which includes the experience and expressions of opinion of a considerable number of railway maintenance officers, indicates that there are many factors today which demand or make desirable and economical the housing of at least a part of the track labor on most railways. In determining what forces are to be housed, if any, consideration should be given to all of these various factors, and to all of the tangible and intangible benefits to be derived, as well as to the costs involved. The scope and furnishings of any housing facilities provided may depend to some extent upon local conditions and upon the class and social habits of the labor to be housed, but in all cases, the facilities should be maintained in a clean, safe and sanitary condition, with due consideration



On Wednesday Night the Roadmasters and Their Families Were Guests of the Track Supply Association at the Annual Dinner

to the comfort and general welfare of the men.

Committee—J. A. Turner (chairman) rdm., A. C. L., Sanford, Fla.; N. D. Howard (vice-chairman), eastern editor, *Railway Engineering & Maintenance*, New York.; W. M. Anderson, rdm., S. A. L., Birmingham, Ala.; E. L. Banion, rdm., A.T. & S.F., Independence, Kans.; C. C. Clark, rdm., Sou. P., Ogden, Utah.; M. H. Dick, associate editor, *Railway Engineering & Maintenance*, Chicago; L. J. Drumeller, div. engr., C. & O., Hinton, W. Va.; H. E. Kirby, asst. cost engr., C. & O., Richmond, Va.; C. A. Lichty, ret. insp., C. & N. W., Chicago; E. F. Manson, div. engr., C. R. I. & P., Fairbury, Neb.; E. L. Potarf, dist. engr., C. B. & Q., Omaha, Neb.

The Track Supply Exhibit

H. H. Talboys
President

IT was with no slight misgivings that the officers of the Track Supply Association prepared plans for the resumption of the exhibit in 1934, when word was received that the Roadmasters' association would hold a convention after four years of restricted activity. However, thanks to the courage and persistence of the leaders of the supply association, 38 manufacturers were prevailed on to take space. While this group of exhibitors represented little more than half the number who participated in the last previous exhibit, held in 1930, the show was thoroughly successful and afforded the incentive for greater efforts in following years. The result has been a steady growth in the size of the exhibit, space being taken by 40 companies in 1935, 45 in 1936 and 53 this year.

The secretary has been aided in his solicitation by the fact that visitors have not been confined in recent years merely to those in attendance at the Roadmasters' convention. Because of their interest in the products on display, several committees of the American Railway Engineering Association have adopted the practice of holding meetings in Chicago during the week of the exhibit, and five of the committees were in Chicago for one or two days during the convention this year.

The officers of the Track Supply Association who were responsible for the preparation and conduct of the exhibits were: President, H. H. Talboys, Nordberg Manufacturing Company, Milwaukee, Wis.; vice-presidents. Jess Mossgrove, Austin-Western Road Machinery Company, Aurora, Ill., and Lem Adams, Oxweld Railroad Service Company, Chicago; secretary-treasurer, Dan J. Higgins, Gardner-Denver Company, Chicago; directors, Frank J. Reagan, American Fork & Hoe Company, Chicago; Lewis Thomas, Q. & C. Company, Chicago; R. J. Platt, Positive Rail Anchor Company, Chicago; R. J. McComb, Woodings-Verona Tool Works, Chicago; J. E. Mahoney, P. & M. Company, Chicago; F. W. Anderson, Northwestern Motor Company, Eau Claire, Wis.; and E. C. Argust, Morden Frog & Crossing Works, Chicago.

In the election of officers Mr. Mossgrove was advanced to president and Mr. Adams to first vice-president, Mr. McComb was elected second vice-president, and Mr. Thomas was elected secretary-treasurer. Ross M. Blackburn, Buda Company, Chicago; Howard C. Mull, Warren Tool Corporation, Warren, Ohio; and H. M. McFarlane, O. F. Jordan Company, East Chicago, Ind., were elected directors.

The list of exhibits, together with the materials on exhibit and the names of the companies' representatives, follows:

D. J. Higgins
Secretary-Treasurer

List of Exhibitors

Air Reduction Sales Company, New York; welding and cutting equipment, oxygen and acetylene regulators, carbide lights, lamps and lanterns, carbide, welding rods, goggles, and built-up and heat-treated rail joints; C. B. Armstrong, A. W. Brown, C. A. Daley, J. T. Gillespie, J. W. Kenefic, L. C. McDowell, U. F. Portel, H. L. Rogers, E. F. Turner, M. M. Weist, and D J Williams

American Fork & Hoe Company, Cleveland, Ohio; rail anchors, tapered rail-joint shims, shovels, weed cutters, forks, rakes, scuffle hoes, and broom rakes; H C. Branahl, G. L. Dunn S. L. Henderson, J. J. Nolan, Frank J. Reagan, and F. C. Stowell.

American Hoist & Derrick Company, St. Paul, Minn.; photographs of work equipment; Stanley M. Hunter, Ward B. Maurer, and Harold O. Washburn.

Austin-Western Road Machinery Company, Aurora, Ill.; models and moving pictures and literature on air dump cars and power shovels; H. F. Barrows, J. D. Benbow, H. B. Bushnell, Jess Mossgrove, Bruce P. Smith, and A. O. Teckemyer.

Barco Manufacturing Company, Chicago; gasoline tie tampers, stoves, sand dryers, flexible ball joints, and gasoline hammer; C. E. Allen, F. N. Bard, W. J. Belhke, C. O. Jenista, L. J. Lytle, and C. L. Mellor.

Buda Company, Harvey, Ill.; section motor car, inspection motor car, one-man inspection motor car, mechanical tie tamper, electric tie tamper, switch stand, bonding drill, track drill, track liners, rail bender, journal jacks, track jacks, tool grinder, and tie spacers; R. M. Blackburn, H. S. Brown, R. B. Fisher, F. L. Gormley, G. W. Hoover, and G. A. Secor.

Carborundum Company, Niagara Falls, N.Y.; grinding wheels and blocks for trackword, literature on grinding and special wheels; R. C. Bradbury, H. C. Jones, R. A. Kindig, and B. H. Work.

Caterpillar Tractor Company, Peoria, Ill.; pictures of Caterpillar tractors; G. A. W. Bell, Jr., Ralph Dunn, Reid Evans, J. H. Fitzgerald, Eugene Larsen, and Ralph Schiesswolhl.

Chicago Pneumatic Tool Company, New York; air compressor, tie tampers, and pneumatic tools; D. Brown, C. L. Butler, P. J. Christie, G. Coffey, S. J. Congdon, H. R. Deubel, W. J. Pallowick, and W. L. Stockwell.

Chipman Chemical Company, Inc., Bound Brook, N.J.; C. M. Burpee, M.

Larsen, N. J. Leavitt, J. Murawski, and I. J. Strain.

Creepcheck Company, Inc., Chicago; rail anchors; T. D. Crowley, R. R. Dinklage, and U. A. Howell.

Crerar, Adams & Co., Chicago; track and bonding drills, track tools, tie bander, wrenches, rust-proof paint, hydraulic pipe pushers, and conduit bender; T. D. Lewis, Edward C. Poehler, Irving E. Poehler, J. M. Temple, Thomas F. Tough, and Louis K. Wietz.

Crown Rock Sales Company, Chicago; Asphalt paving material; William T. Damewood, E. B. Marshall, and J. T. McDonough.

Cullen-Friestedt Company, Chicago; motion pictures of Burro locomotive crane in operation, and rail tons; W. C. Bamber, K. J. Beller, L. B. Bertaux, C. J. Bronez, E. V. Cullen, F. J. Cullen, F. P. Cullen, T. G. Frazee, G. H. Goodell, Robert W. Jamison, F. L. Kendig, and Jos F. Leonard.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.; track jacks, power jacks, journal jacks, automatic lowering jacks, and tie spacers; C. N. Thulin and E. E. Thulin.

Eastic Spike Corporation, New York; elastic rail spikes; William A. Fisher, A. C. Jack, and B. Kuckuck.

Electric Tamper & Equiment Company, Ludington, Mich.; tie tamper, ballasting and discing blades and tips, and concrete vibrator; H. W. Cutshell, A. V. Gibbs, F. E. Gilbert, Ray Johnson, E. R. Mason, A. H. Nelson, Lowell S. Osborn, L. W. Swett, and G. L. Walters.

Fairmont Railway Motors, Inc., Fairmont, Minn.; inspection car, section car, and heavy-duty motor car; George Adams, C. P. Benning, W. D. Brooks, Kenneth Cavins, W. G. Day, Arthur R. Fletcher, C. H. Johnson, W. F. Kasper, J. T. McMahon, V. Pagett, W. H. Ripken, J. E. Simkins, H. A. Sly, and William Williamson.

Hayes Track Appliance Company, Richmond, Ind.; bumping posts, wheel stops, and portable derail; S. W. Hayes, Herbert J. Mayer and Paul C. McClure.

Hubbard & Co., Pittsburgh, Pa.; track tools, alloy track chisels, spike mauls, sledges, picks, wrenches, claw bars, adzes, and alloy spring washers; D. J. Crowley and J. S. Wincrantz.

Illinois Malleable Iron Company, Railroad Division, Chicago; rail anchors; Chas. G. Ericson and H. A. Morgan.

Ingersoll-Rand Company, New York; pneumatic tie tampers, track wrench, rail drill, spike driver, screw-spike wrench, clamp-bolt wrench, and impact wrench; W. H. Armstrong, G. E. Bridge, G. W. Morrow, K. I. Thompson, and T. H. Weigand.

International Harvester Company, Chicago; tractor and Diesel power plant; W. J. Banks, R. C. Flordin, W. F. Hebard, W. Hensel, Neal Higgins, D. F. Hipskind, D. Jone, R. L. Knudtson, Wm. Parrish, A. W. Turner, and L. W. Warfel.

Jordan Company, O. F., East Chicago, Ind.; model and pictures of spreader ditcher; A. W. Banton, O. L. Champion, J. C. Forbes, and H. M. McFarlane.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; one-man inspection car, light section motor car, signal maintainer car, motor-car wheels, and track gage and level; L. W. Bates, Ralph E. Keller, Frank E. McAllister, and P. J. Robischung.

Lundie Engineering Corporation, New York; tie plates and tie tongs; L. B. Armstrong, D. H. Mayer, and O. W. Youngquist.

Maintenance Equipment Company, Chicago; Switch point protector, rail and flange lubricator, derail, and literature on rail layer; D. M. Clarke, E. Overmier, T. E. Rodman, R. J. Shanahan, and P. A. Wells.

Mall Tool Company, Chicago; portable rail grinders, flexible-shaft cross-grinder, concrete vibrator, sump pump, 10-in. power saw, chain timber saw, lag-screw wrench, boring attachment, and concrete rubber; J. Innes, A. W. Mall, F. A. McGonigle, and M. Rhenquist.

Metal & Thermit Corporation, New York; thermit-pressure rail welds and welding rods; A. Lucas and C. D. Young.

Morden Frog & Crossing Works, Chicago; heat-treated forged compromise joints, adjustable rail braces, and miscellaneous forged fittings for switches; E. C. Argust, W. Homer Hartz, G. F. Killmer, L. I. Martin, and Sam Withrow.

Nordberg Manufacturing Company, Milwaukee, Wis.; rail grinders, track power drill, power track wrench, utility rail grinders, and accessories; C. P. Clemmens, W. W. Fitzpatrick, C. K. Jensch, and H. H. Talboys.

Northwestern Motor Company, Eau Claire, Wis.; hump and extra-gang car; section and inspection motor cars, motor car wheels, and rail and frog surface grinder; F. W. Anderson, R. G. Clark, M. Dilley, Otis B. Duncan, G. H. Goodell, W. N. Jeffress, W. B. Joyce, A. H. Nelson, H. N. Nordlie, G. Prest, W. J. Roehl, W. J. Roehl, Jr., and J. S. White.

Oxweld Railroad Service Company, Chicago; oxy-acetylene welding and cutting apparatus, oxygen, acetylene, carbide, actual examples of battered joint reconditioning, rail butt welding, angle bar welding, switch point welding, frog welding, application of switch point protectors, and heat-treating of rail ends; Lem Adams, M. Burnett, Jr., W. E. Campbell, W. E. Donalds, S. P. Donegan, F. J. Duffie, A. F. Garberding, J. R. Garrett, W. A. Hogan, P. Hunter, Jr., W. H. Kofmehl, D. H. Pittman, C. E. Rigsby, L. C. Ryan, J. C. Stephenson, F. C. Teichen, and J. E. Winslow.

P & M. Company, Chicago; rail anticreepers and bond-wire protectors, and tie plate assemblies; S. M. Clancey, D. M. Clarke, J. J. Gallagher, D. T. Hallberg, P. Hamilton, G. E. Johnson, J. E. Mahoney, W. A. Maxwell, G. E. Olson, W. H. Reaves, Max K. Ruppert, F. S. Schwinn, Jr., G. E. Webster and G. T. Willard.

Pettibone Mulliken Corporation, Chicago; mechanical switchman, switch stands, switch point lock, model of railroad crossing; J. H. Asselin, Walter Brietzke, A. R. Hearl, C. A. Johnson, Carl Landberg, G. R. Lyman, J. D. Potts, and G. J. Slibeck.

Pocket List of Railroad Officials, New York; copies of Pocket List of Railroad Officials; H. A. Brown and B. J. Wilson.

Positive Rail Anchor Company, Chicago; rail anchors, guard-rail plates and braces, and adiustable rail braces; L. C. Ferguson and R. J. Platt.

Power Ballaster Company, Chicago; photographs and motion pictures of power ballaster and cribbing machine; Vic Coble and F. H. Philbrick.

Q & C Company, New York; guard-rail clamp, switch-point guard, electric snow melter, compromise joints, derail, gaging tools, rail and flange lubricator, wheel stops, rail tongs, and gage rods; G. H. Goodell, L. E. Hassman, E. I. Hetsch, G. Prest, J. L. Terry, Lewis Thomas, and C. H. Wilson.

Rail Joint Company, Inc., The, New York; insulated rail joints, standard joints, controlled bearing joints, compromise joints, and fibre insulation; E. W. Backes, Alex Chapman, W. E. Gadd, Harry C. Hickey, G. H. Larson, J. N. Meade, R. W. Payne, and Thomas Ryan.

Rails Company, The, New Haven, Conn.; M. & L. track, compression track construction, compression screw spike, full throated cuts pike, oil, gas and electric switch heaters, and track lubricator; L. T. Burwell, G. M. Hogan, and J. V. Wescott.

Railway Engineering and Maintenance, Chicago; copies of *Railway Engineering and Maintenance* and Railway Age; G. E. Boyd, M. H. Dick, L. R. Gurley, S. W. Hickey, N. D. Howard, Elmer T. Howson, F. C. Koch, Walter S. Lacher, J. G. Little, H. E. McCandless, and H. A. Morrison.

Railway Track-Work Company, Philadelphia, Pa.; portable electric track grinders, portable stock-rail grinder, portable reciprocating grinder, portable flexible shaft grinder, and grinding wheels; H. M. Moorhead and A. M. Nardini.

Ramapo Ajax Corporation, New York; switch stands, rail lubricators, and metal highway crossings; W. Bender, W. M. Brooks, G. A. Carlson, G. M. Cooper, R. E. Einstein, H. Hazelton, A. P. Hess, Darcy F. Hilton, P. Hoffman, A. F. Huber, J. S. Hutchins, W. Janicki, S. A. McVickers, and W. Perdue.

Rawls Company, S. E., Streator, Ill.; railway track and right-of-way mowing equipment; C. F. Butts, L. C. Meskimen, and S. E. Rawls.

deSanno & Son, A. P., Philadelphia, Pa.; Radiac grinding wheels; L. E. Buckingham, J. C. Rinehart, E. J. Rohan, and W. K. Whelan.

Sellers Manufacturing Company, Chicago; angle bars; J. T. Flynn and G. M. Hogan.

Standard Equipments, Inc., New York; Evertite rail joints; C. O. Bradshaw and Albert E. Hill.

Teleweld, Inc., Chicago; rail joint shims, samples of welded rails showing effects of pre-heating, samples of heat-treated rail and field hardness testing kit, and welded manganese frog; T. L. Botman, G. A. Green, A. L. LaMasters, E. J. Payton, and W. A. Peck.

Templeton, Kenly & Co., Ltd., Chicago; track, bridge and journal jacks; tie spacer; and rail puller and expander; E. D. Carthy, W. C. Cornu, H. C. Dilsizian, R. B. Hill, P. H. McManus, Charles Neher, William Simpson, J. B. Templeton, and W. B. Templeton.

Western Railroad Supply Company, Chicago; dragging equipment detectors, crossing gate and flashing light signal, rail bonding machine, snow burner, electrical lighted switch lamps, reflector buttons and signs, and rail bonds; Norman Gort, John Hensel, and W. A. Swonger.

Woodings-Verona Tool Works and Woodings Forge & Tool Company, Verona, Pa.; rail anchors, gaging tools, spring-clip and bent-shoulder tie plates, spring washers, and triflex springs; James McComb, R. J. McComb, G. L. McKewin, J. M. Moore, E. Woodings, and W. H. Woodings.

Woolery Machine Company, Minneapolis, Minn.; track motor car, tie cutting machine, and inspection motor car; A. J. Franke, J. W. Vogler, and H. E. Woolery.

What's the Answer?

Fastening Header Rails

Where header rails are used through highway crossings, how should they be fastened?

Opinions Differ

By C. H. Paris
Chief Engineer, Chicago & Illinois Midland, Springfield, Ill.

Header rails may be set with the head either up or "balled in" against the running rail. There seems to be considerable difference of opinion with respect to the use of header rails with the several types of crossings, particularly with some of the new types now on the market or under test. From observation I believe that the use of T-rails as header rails through crossings is declining and is now confined more particularly to second and third-rate crossings.

When head up, the base of the header rail should be set far enough from the running rail so that both the running rail and the header rail can be spiked to the ties in the usual manner; that is, the space between the rail bases should be sufficient to accommodate a spike. The header rail should be spiked to each alternate tie.

When tie plates are in use it may be necessary to install a special long plate that will accommodate both the running and header rails. The alternative is to shear either the base of the header rail or the ends of the tie plates to permit the placing of the two rails the proper distance apart.

Where the header rail is balled in against the web of the running rail, it should be of a size that will fit snugly under the head of the running rail and against its web. The lower part of the head of the header rail will then lock to a certain extent against the spikes holding the running rail. In many cases, this is the only fastening necessary, as the pressure of the plank or other crossing filler against its base is sufficient to hold it in place. If additional fastening is desirable, four holes should be drilled through the web so that lag screws can be applied to hold it to the ties. Obviously, the lag-screw heads should clear the wheel flanges, as it is necessary to have a flangeway depth sufficient to clear these flanges.

Another method of fastening is to apply a strap iron to each end of the header rail, securing them to the ties to prevent longitudinal movement, as this may be the only movement to guard against. One of the common causes of failure is that of placing two rails through long crossings without welding the abutting ends.

Uses Several Methods

By Assistant Chief Engineer

We do not use a special flangeway rail on our rail-type crossings, that is, crossings built of old rails, but set all of the rails comprising the crossing work wise, those next to the running rail being placed to give flangeways about 3 in. wide. This rail, as well as the remainder of the crossing rails, are set in creosoted shims on top of the ties to bring them to about the height of the running rails. The rail forming the flangeway on each side is fastened on the side next to the running rail by means of boat spikes or lag screws through the unused hole in the tie plate, a special square-cut washer that extends over the base of the rail being used as a clip.

Where the running rails are 90 lb. or less, we used a 75-lb. rail balled against the web of the running rail for flangeway purposes with concrete crossings, a number of which we have on our line, which are generally built by the state highway department. The lower edge of the base of this flangeway rail is blocked up with sections of old plates to keep the base vertical. It is fastened through holes in the

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in December

1. What causes short line kinks in track ballasted with stone? What methods can be employed to overcome the trouble? Do they occur with other kinds of ballast?

2. Should bolt holes for sway bracing on pile trestles be the same diameter as the bolt, or larger or smaller? Why? If the latter, how much?

3. Can rail that has been precurved be transposed? Is it suitable for relaying in secondary tracks when released? In yards and sidings? If not, why? If so, how should it be laid? Does the weight of the rail or the degree of curvature make any difference?

4. What is the maximum allowable pitch for a tar and gravel roof? The minimum? What considerations determine this?

5. Should the interval between bolt tightening be determined by the tonnage passing over the track, or should the tightening be done periodically? Why?

6. What factors determine the location of water columns on main tracks? At engine terminals? In yards?

7. On what grounds can the installation of rail and flange lubricators be justified?

8. What are the most common causes of failure in culverts? How can they be overcome?

web by means of either boat spikes or lag screws through the unused holes in the tie plates, spaced about every third tie.

For this type of crossing, where the running rails are heavier than 90 lb., we have recently used a flangeway made up of second-hand 4-in. by 4-in. angles riveted back to back. When used with 112-lb. rail, the lower leg of the assembly is cut to 3⅜ in., the upper leg to $3\frac{5}{16}$ in., and the back-to-back flanges to 3⅞ in. This gives a flangeway width of 2⅜ in., and there is sufficient depth to permit the heads of the lag screws used for fastenings, to clear wheel flanges. These screws pass through thimbles made of ¾-in. pipe, and the unused holes in the tie plates of every third tie.

Welding Versus Riveting

What are the advantages and disadvantages of welding as compared with riveting, in making repairs to steel bridges?

Can Maintain Traffic

By E. H. Botts
Assistant Engineer, Norfolk & Western, Bluefield, W. Va.

If the structural elements that make up the major members of the bridge are not too badly deteriorated, the repairing of steel bridges by welding has the decided advantage that traffic can be maintained without resort to falsework for supporting the tracks. As a general rule, this method is much cheaper than riveting. It is false economy to make repairs to structural elements that are badly deteriorated, in which event falsework is generally required to support tracks carrying traffic. If such repairs must be made, however, I would favor riveting as it has the advantage of more definitely known strength per unit.

Possesses Advantages

By C. S. Heritage
Bridge Engineer, Kansas City Southern, Kansas City, Mo.

The increasing use of welding for making repairs to bridges is a strong indication that it possesses advantages, as compared with riveting, for this class of work, some of which follow. When adding material to tension members, less material is required to produce the same result, since the section is not reduced by rivet holes. Welding sometimes avoids the necessity for drilling holes in the original section, which would further reduce the cross section and would have to be made up by still more material.

Where members or pieces can be welded together directly there is a saving of the connecting pieces that are required for riveted work. For applying stiffeners to girders and beams, material can be saved because only a single plate, corresponding to the outstanding leg of the stiffener angle, can be used. It is unnecessary to machine the ends of stiffeners to obtain a bearing on flanges, since this result can be obtained directly by welding. Again, welded stiffener plates can be applied on old work where it would be difficult to rivet on new stiffeners because of close spacing of the rivets in the flange angles.

Many bridge repairs can be made by welding without disturbing or removing parts from the existing structure, where the same repairs by riveting would require the removal of parts, thus temporarily weakening the member while the work is going on. Some examples are cracked lateral plates, it being possible to make the repairs by welding and placing a patch plate, or in some cases by welding a patch plate. Eye bars in web members of trusses can be shortened and adjusted without removing the member and without removing the load. Girder stiffeners over bearings can be built up by welding or by welding a reinforcing plate to the outstanding leg of the stiffener.

Where bridge pins or pin holes are badly worn, it is practicable to make repairs by welding blocks against the pins and to the bridge members, holding them firmly in place. It is also possible to fill in shims around the worn spaces. This type of repair makes a rigid joint, but where it has been used, good results have been obtained.

Weak shoes can be reinforced by welding on stiffeners and diaphrams. In some cases, pieces can be welded to transmit some of the load directly from the pin to the bearing and thus relieve the web members of the shoe of some of their load. Likewise, the reinforcement of stringers, floor beams and girder flanges can usually be done more easily by welding. The strengthening of connections, such as stringers to floor beams or floor beams to truss members can usually be done by welding where, in some cases, it would be difficult or even impracticable to increase the number of rivets in the connection. In some cases, also, a considerable amount of falsework can be avoided by substituting welding for riveting.

There are also certain disadvantages in welding as compared with riveting, because surfaces in contact are not drawn together tightly as is done in riveting. The quality of riveting work can be determined more accurately by inspection after the job is finished than can be done with welding. A considerable amount of investigation is still needed to determine the action of welded work under vibration and impact stresses.

Welding for bridge repairs must be done by competent operators under good supervision and inspection. Unless the work is handled carefully it will not be as uniform as riveted work. In general, both welding and riveting have their places in bridge repair work, and we frequently use both methods in different places on the same structure.

Skilled Welders Scarce

By A. E. Bechtelheimer
Assistant Engineer of Bridges, Chicago & North Western, Chicago

It will be found frequently that connections can be strengthened by welding without disturbing the existing details or, at worst, with minimum disturbance. It is possible to fit specially formed plates over rivet heads at connections of floor beams to girders and by arc welding to strengthen the connections. Or, a weak detail in a connection can be brought up to the strength of the remainder of the connection.

In many instances, girder and column connections can be repaired and strengthened by arc welding, generally at less expense than by riveting. Worn and defective materials can be cut out, new material fitted in and, by arc welding, the bearings can be made fully effective. Where extensions are to be made to encased structures, the new steel can be connected to the existing steel with minimum disturbance to the encasement.

It is particularly advantageous to do small jobs by arc welding, as the equipment for this purpose can be moved to the job more easily than riveting equipment. Also, fewer men and less equipment will be required.

Stringers in floor systems can be surfaced more advantageously by

welding shim plates to the top flanges of the stringers. In general, shim plates are thin sections in connection with which countersunk rivets cannot be used to advantage.

The disadvantages of arc welding in repairs to steel bridges are the lack of knowledge pertaining to its practical application and the scarcity of skilled operators possessing the required technical knowledge to handle this type of work successfully.

Filling Cracks in Plaster

What material is most satisfactory for filling shallow cracks or uneven places in plaster walls? How should it be applied?

Mentions Several Methods

By W. E. Gardner
Principal Assistant Engineer, Wabash, St. Louis, Mo.

Hair-line cracks in plaster can be filled by brushing them full of a paint mixed from patching plaster and water to the consistency of heavy cream. It is necessary, however, to do considerable rubbing with steel wool or sandpaper to restore a smooth surface to the wall. A thick coat of paint will usually fill hair-line cracks satisfactorily, but to make certain that the plaster will not absorb too much oil from the paint it is safer to brush over the cracks with shellac.

Cracks too large to fill by painting should be undercut along each edge so that the patch will be wedged in place. Sometimes one edge of the crack will be higher than the other, in which event sufficient old plaster should be removed to insure a level surface across the patch. Before the patching plaster is applied, the edges of the old plaster should be soaked thoroughly with water to insure a good bond.

For filling cracks larger than hair lines, the most convenient and satisfactory material is one of the numerous prepared, non-shrinking patching plasters which are on the market in 1, 5 and 30-lb. cartons. This material is mixed with water to the consistency of putty and applied with a putty knife or trowel, and should be knifed or troweled sufficiently to leave a glazed surface on smooth walls, or stippled with a stiff bristle brush on sand-finish walls. After it is dry, it should be smoothed up around the edges with steel wool or sandpaper and given a coat of shellac.

To fill uneven places in plastered walls, the outline of the low spots should be located as definitely as practicable by means of a straight edge. The low place can then be filled with patching plaster after the surface has been scratched to produce a bond. The plaster should be well troweled and then brushed over lightly with water to smooth it down. Such a patch should have a coat of shellac before painting.

Suggests Swedish Putty

By General Inspector of Buildings

While there are numerous preparations on the market for filling shallow cracks and depressions in plaster walls, some of which have considerable merit and others very little, what is probably the best material for this purpose is the least known and is rarely used. There are two reasons for this—it is suitable for this purpose only, and it hardens so slowly that it is not suited for jobs that must be done quickly.

This material, which is known as Swedish putty, is easily prepared by adding calcimine to an equal amount of ordinary flour paste, enough water being used in the latter to give the desired consistency, and mixing very thoroughly. After these two ingredients are thoroughly incorporated, about 10 per cent, by weight, of boiled linseed oil should be added and mixed in thoroughly. It is then applied by means of a putty knife or trowel and after it is hardened it should be smoothed up in the usual manner. Because of its slow setting, the amount necessary for a relatively large job can be made up at one time, an advantage as compared with materials containing plaster of Paris, which set up too quickly to permit this.

Another mixture which does not give as good ultimate results, but which can be relied on to penetrate into very fine cracks and to hold well when applied to shallow depressions, is made by reducing calcimine to a thick smooth paste by the addition of warm water. Proportioning by weight, three parts of this paste and two parts of heavy white lead paste are then mixed, care being taken to produce a homogeneous mixture. Immediately before it is to be used, one part by weight of dry plaster of Paris is added and well mixed in. If the mixture is then too dry and thick it can be thinned by the addition of a small quantity of cold water. This mixture hardens rather quickly, but setting can be retarded by adding a small amount of boiled linseed oil.

Spacing for Motor-Car Setoffs

At what intervals should motor-car setoffs be provided on single track? On multiple tracks? Should they be placed on the inside or outside of curves? Why?

Where Most Needed

By Robert White
Section Foreman, Grand Trunk Western, Saranac, Mich.

No inflexible rule can be laid down for the spacing or location of motor-car setoffs. They should be placed where experience has shown that they are most needed. The track foreman who is familiar with his section knows exactly where they will do him the most good and should be allowed to place them in accordance with his judgment, without regard to uniform spacing.

These comments apply equally to setoffs on single and on multiple tracks. For appearance sake they will look best if placed at stated intervals, but this is a facility for utility and not primarily for appearance, and if they are not built where the foreman needs them he is placed at a disadvantage in his work, and perhaps with respect to safety as well.

While they are not intended primarily for appearance, there is no reason why they should not be constructed and maintained as neatly as practicable so that they will not detract from the appearance of the right of way. A slovenly setoff cannot be defended.

A location should be chosen which will permit the car to be removed from and replaced on the track with the least effort. If this can be done better on the outside of a curve the

setoff should be placed on this side; if on the inside, this side should be chosen. In other words, it is immaterial which side of the curve is selected, except so far as it furthers the convenience of the forces making use of the setoff.

At Short Intervals

By Project Engineer

Motor-car setoffs are constructed for two purposes, namely, to reduce the amount of effort required to remove the cars from the track and replace them, as well as to provide a suitable place to leave the cars when not in use. They should be placed at as short intervals as the material available for building them permits, the reason for this being that it will overcome the necessity for the men walking too great a distance to reach their work.

Earth setoffs should never be built. By this is meant the type with ballast or with two ties on top with ballast between the rails to the height of the rails. Almost invariably a motor-car trip after a hard rain will disclose mud on the track caused by blocked drainage at setoffs of this type. A record of the time spent in working around such a setoff will indicate that they are about as expensive to maintain as an earth-filled highway crossing, and that more time may be devoted to this work than is required to walk a longer distance to reach a timber setoff.

Expansion in Pipe Lines

How can expansion and contraction best be taken care of when installing long runs of hot-water and steam lines?

Pipe Must Be in Line

By John Cole
Water Service Foreman, Canadian National, Toronto, Ont.

The movement to be cared for can be determined easily if the temperature of the steam or water is known, this being ¾ in. per 100 ft. of line where the variation in temperature is 100 deg. F.; 1.6 in. for 200 deg.; and 2.5 in. for 300 deg. If the pipe is 2½ in. or under, U-bends may be made from the pipe. These will prove satisfactory and economical. If the pipe is larger than 2½ in., I suggest expansion joints of the telescopic type, with a traverse which is a little over the requirements of the line. These joints should be equipped with guides and anchor bolts, to eliminate danger of the joints being blown apart.

It is important that the pipe be lined properly and anchored so that it will remain in line, for expansion joints will not operate satisfactorily if they are not truly lined. If they do not do the work for which they were designed, there is likely to be a break at the weakest point in the line, for the stresses of expansion and contraction may be very great.

It is also important to have bleeders in steam lines at approximately regular intervals for draining the condensate. These are preferably steam traps draining into return lines, but if this is not practicable they can drain to the atmosphere. Condensate allowed to remain in the line will shorten the life of an expansion joint and may give much trouble otherwise.

On long runs of cold-water pipes where the line may be exposed to marked variations in temperature, particularly where there may be long intervals when very little water is drawn from them, the lines should be installed with double-elbow or swing joints to care for movement under temperature changes. I have known such a line to pull apart at valve connections under a drop of only 40 deg. in temperature, while after swing joints were installed no further trouble was encountered.

Expansion Loops Best

By L. C. Winkelhaus
Assistant Engineer, Chicago & North Western, Chicago

The preferable method of taking care of expansion and contraction in long runs of hot-water and steam lines is by means of horizontal loops. The reason for this is that such loops are easy to install, particularly if welded, require no maintenance, and experience has shown that their performance is satisfactory. However, the field for this form of construction is limited, for space is not always available for the loops; they cannot be used in vertical runs; and they are generally impracticable for underground runs.

Expansion joints can be installed under almost any condition of pipe construction. They are neat, take very little additional space and, with proper maintenance, should give very little trouble. At the end of each heating season they should be overhauled, giving special attention to the packing. When installing either expansion loops or expansion joints, it is essential that adequate anchorage be included.

Requires Individual Study

By David J. Jones
Mechanical Assistant, Building Department, Illinois Central, Chicago

Taking care of expansion in long runs of hot-water and steam lines requires individual study of each particular project. The features requiring consideration include (1) whether the line is an outside one and whether the pipe is to be insulated or left bare; and similar information for pipes (2) inside buildings, (3) in pipe tunnels, (4) underground in tile conduits and (5) underground without conduit protection.

Another consideration is the climatic conditions surrounding the installation. Well-insulated pipes are not subject to the variations in temperature that affect poorly insulated or uninsulated pipes. When the foregoing information is at hand, the amount of movement in expansion and contraction to be taken care of can be determined and plans made accordingly.

Expansion and contraction can be taken care of by a number of methods, among which are (1) expansion joints of the bellows type or (2) of the mechanical-slip-joint type; (3) pipe expansion bends; (4) expansion loops consisting of lengths of pipe not bent to any particular radius; and (5) swing joints consisting of pipe and fittings. Any of these methods can be used successfully, although each method differs somewhat from the other, so that their use will be dictated by conditions surrounding the installation.

Method (1) is preferable where it is desired to install the pipe in a straight line because it requires little or no maintenance. Method (2) requires maintenance, such as packing joints, etc. Methods (3) and (4) are somewhat similar, but (3) is preferable because the pipe bends can be designed scientifically and can better be adapted for the conditions surrounding the installation. Method (5) involves the installation of drip pockets and traps to care for the condensation that will accumulate in

steam lines. When this type of expansion joint is used in hot-water lines, it is necessary to make provision for drainage.

Expansion and contraction can sometimes be taken care of in the installation of a pipe line in a manner that will eliminate all of the foregoing methods. This is done by installing the line so that all long runs will be eliminated by providing turns at points of advantage. This method cannot be used successfully at all times because the surrounding property does not always lend itself to this arrangement. The main thought to keep in mind is that a commodity having a higher temperature than the surrounding atmosphere is being handled and that to do it properly requires adequate provision for expansion and contraction.

Why Ties Fail Under the Rail

Why do most ties fail under the rail? What can be done to eliminate or reduce these failures?

Destroyed Mechanically

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

Mechanical action created by movement of the rail or tie plate with respect to the tie is the principal reason for tie failures under the rail. The chafing of the wood which results from this movement allows water to penetrate the wood and this, in turn, allows the wood fibre to crush, after which the tie will rot rapidly under the rail. Other causes for like failures are an insufficient number of ties to the panel, and inadequate bearing area because tie plates are too small or are not used.

Spike killing is another important cause of failure, usually resulting from frequent gaging of sharp curves or of track that is not adequately drained.

Failure to use treated tie plugs will hasten decay around spike holes. The disruption of the wood fibre from spiking exposes the interior of the tie to infection from decay-producing organisms and thus tends to hasten decay and materially shorten the life of the tie.

To reduce or eliminate these failures, ties should be treated with a preservative which is not only poisonous to these organisms, but also provides a water repellant or a waterproof coating for the surface of the tie. Mechanical destruction can be reduced by fastening the plate rigidly to the tie by means of a fastening which is independent of the rail fastening. Double-shoulder tie plates of ample area reduce mechanical action still further.

When relaying rail or where the rail must be removed for other reasons, the spike holes should be plugged with creosoted tie plugs, which will fill the spike holes completely. This will exclude moisture, prevent decay and provide solid wood for redriving the spikes. Machine adzing is preferred where practicable, because a more even bearing is secured than is possible with hand tools. Any adzed surface should have an application of hot preservative. Pre-boring will insure full penetration of the preservative around the spike holes, as well as eliminate much of the fibre crushing which occurs where spikes are driven into unbored ties.

Most Severe Service

By C. D. Turley
Chief Tie Inspector, Illinois Central, Chicago

Most ties fail under the rail because the service at that point is more severe and the opportunities for mechanical damage are greater than elsewhere. Crushing, rail or plate cutting, spike killing and decay around spike holes are common causes which account for approximately 50 per cent of all tie failures. Crushing can be reduced by the use of large tie plates and, where wheel loads and the volume of traffic justify it, the size and length of the ties should be increased.

Rail and plate cutting reached rather high proportions when ties were placed in the track with small plates or with no plates. The present practice of placing large plates on new ties as they are installed has greatly reduced failures of this type. Spike killing can be reduced to the minimum by careful track maintenance. Loose ties and rail creepage account for much of this trouble. Large tie plates to hold gage and careful co-operation from the trackmen are necessary, however, to reduce failures of this type. Decay under the rail seat, originally caused in large part by improper preservatives and methods of preservation, as well as lack of penetration around spike holes, has been greatly reduced by improved treatment, preboring and pre-adzing.

Starts at Beginning

By J. Morgan
Retired Supervisor, Central of Georgia, Leeds, Ala.

Through observation of the performance of ties for many years I have reached the conclusion that one of the important causes of failure is the methods followed in installing them. The plates in most common use have either ribs or corrugations on the bottom, and a large percentage of them are placed on the ties to be seated by traffic. Either form of bottom will distort the wood fibre, producing a basin for water when it rains, thus softening the mashed fibre and accelerating the mechanical destruction which continues with every wheel that passes over the tie. Another factor detrimental to tie life is the sharp edges and corners which characterize most tie plates. Plates that are not fastened to the tie in such manner as to eliminate relative movement between them, subject the wood to constant abrasion as wheels pass over them, producing a surprising amount of wear over a period of years.

Obviously, the remedy is to eliminate the cause. If ribs are to be used, and I favor them, the ties should be scored to receive them at the time they are adzed before treatment. Corrugated and checkered bottoms are highly destructive to ties. Sharp edges and corners should be eliminated from tie plates. Independent fastenings to hold the plate rigidly to the tie will add years of life to the latter. No mention has been made of spike killing or the use of tie plugs, for these causes of failure are so obvious. Yet, although they are matters of common knowledge to trackmen, thousands of ties are destroyed annually by careless spiking.

Two Reasons Principally

By C. H. Vogt
Supervisor of Track, Central Railroad of New Jersey, Jersey City, N. J.

Ties fail primarily through decay and mechanical destruction. At one extreme is the line of light traffic in which decay acts slowly because there is little mechanical damage to stimulate it, for which reason the ties have long service life. At the other is the heavy traffic line in which mechanical action is at the maximum, often shat-

tering the tie before decay can advance enough to become a determining factor. Most ties, however, lie intermediate to these two extremes.

Formerly, decay was the most important cause of tie failure, because the ties were untreated. Today, with adequate preservative treatment, mechanical destruction is the underlying cause of most failures, for there are more years of sound wood in present day ties, giving a longer period during which these forces are able to attack the ties. This form of attack takes place under the rail and includes abrasion from above and the effect of tamping below.

Other factors include spiking and the admission of moisture to the spike hole. Spikes should be driven home and then let alone. Every time a spike is tapped down the wood fibres are damaged and their holding power is lessened. Spikes work up because of defects in track surface, and these should be corrected. When a spike is withdrawn a treated tie plug should be driven into the hole, even though the spike is not to be redriven. When redriven, spikes should always go back into the same holes, for the more holes there are in the tie the more points of attack by decay are provided.

The size of the tie plate is a factor in tie life. Usually all tie plates for the same rail are of the same size, but they should vary to match the density of traffic. It should be kept constantly in mind that one gets the most service out of these ties which can be kept in the track until they must be removed for decay. Ties last longest in a dry track supported on a dry roadbed.

Two Types of Failure

By O. K. Lawson
Assistant Cost Engineer, Chesapeake & Ohio, Hinton, W. Va.

Tie failures fall into two general classes: mechanical failures and failures from decay. Those that fail from mechanical destruction fail under the rail, while most failures from decay are first noticeable under the rail. Mechanical destruction can be eliminated or at least reduced to the minimum by using only hardwood ties on curves or in places where there may be exceptional strain on the tie under the rails, and by the use of large tie plates, preferably of the double-shoulder type, say 8 in. by 13 in., which are fastened to the ties independently of the rail fastening.

Failures from decay can also be reduced to the minimum by the use of a large plate with independent fastenings. The use of plates of this type will almost wholly eliminate the necessity for regaging, thus preventing unnecessary abuse of the tie by spike cutting which always, even with the best of precautions, opens up the way for water to creep into the tie. In no event should regaging be done without first plugging the old holes and swabbing all abrasions with a preservative. When laying rail out of face, where it is necessary to adze the ties, all adzed surfaces should be swabbed with the preservative.

Double-Shoulder Tie Plates

When laying new rail on double-shoulder tie plates, what precautions should be observed? Is it desirable that one shoulder be brought to a bearing against the base of the rail? If so, which?

Against Outside Shoulder

By A. B. Chaney
District Engineer, Missouri Pacific, Little Rock, Ark.

When laying new rail on double-shoulder tie plates a number of precautions should be observed, including, (1) all ties normal to the track; (2) the tie plates centered on the ties; (3) the plates should have a uniform bearing; (4) the track should be gaged carefully before it is spiked; and (5) the rail and the shoulders of the plates should fit properly.

It requires extra labor to space or straighten ties after the application of double-shoulder tie plates. When ties are straightened or respaced, it often becomes necessary to reset the plates because there is usually a close fit between the rail base and the shoulders. Again, to reset the plate it is necessary to remove the spikes, and respiking reduces the life of ties. A uniform bearing on the tie is necessary to eliminate the necessity for regaging and respiking after the plate is seated under traffic. It is also desirable that the outside shoulder of the plate be brought to a bearing against the base of the rail in order to maintain accurate gage.

Simple but Important

By Oscar Surprenant
Roadmaster, Delaware & Hudson, Schenectady, N. Y.

When laying new rail on double-shoulder tie plates the precautions are simple, but each one is important. The ties must be adzed to fit the cant of the tie plate, which on the D. & H. is 1 in 40, and all spike holes must be plugged. The tie plate must square with the tie and the rail, with the outside shoulder brought to a bearing against the base of rail. The drilling of the tie must be vertical and in the center of the tie-plate hole, using a centering device on the drilling machine. To insure this the ties must be straightened and spaced prior to laying the rail. Only by adhering strictly to these requirements can good results be obtained.

Many Items to Watch

By Arthur H. Peterson
Roadmaster, Chicago, Milwaukee, St. Paul & Pacific, Chicago

When laying new rail on double-shoulder tie plates, care should be exercised to adze all ties properly, to insure a uniform bearing over the entire area of the plate. Special attention should be given to hand adzing, for if the old rail has tipped out it is essential that deeper adzing be done toward the inside. Spike stubs should be driven down and all holes plugged.

Two shoulders are confusing to men not familiar with their use, for which reason intensive supervision may be necessary to insure that they are set properly, particularly if they are canted, since setting the cant the wrong way may cause rail breakage. Furthermore, most tie plates are designed to give more bearing area outside the rail than inside and a reversed plate, even with a flat bearing, is likely to tip outward after a short time.

All ties should be straightened and the tie plates should be centered on the ties, with the outside shoulder flush with the outside of the base of the rail. If the ties are slued, the shoulder should be against the rail base, even if this does not square it with the tie. After the rail is in place it should not be moved more than necessary to avoid shifting the plates or getting the shoulders under the rail.

After the rails are bolted one or two men should follow with bars or mauls to straighten shifted plates and

shift those which may have a shoulder under the rail. This will facilitate the gaging and spiking. In spiking, the inside spike should be started first to draw the outside shoulder snugly against the outside of the rail base. By doing this gage widening under traffic will be held to the minimum.

Most double-shoulder tie plates are punched for independent fastenings, the application of which should be delayed until the plates become seated. If ballasting is to follow closely behind the rail gang, this will reduce the number of spikes to be pulled, there will be less plugging to be done and less injury will result to the ties, especially in regaging, than if the anchor spikes have been inserted previously.

Stones and foreign matter should not be permitted to get between the tie plate and the rail or the latter will be canted when the spiking is done. Later, the foreign object will be crushed by traffic and the rail head will move in or out, as the object is under the inner or outer half of the rail base, resulting in distorted gage.

If the old rail is battered or surface bent at the joints, or the track is in poor surface, many low ties will be found as the new rail is laid. Such ties should be tamped up to a solid bearing or shimmed, preferably the former, before trains are permitted over the new rail. This must be done to insure a uniform bearing for the new rail and to give the tie plates an opportunity to seat themselves. Low ties should be nipped up as the spiking is done and a distinctive mark should be placed on the rail, so that the tampers who follow will know which ties are swinging. If the low ties are spiked without being brought up to the rail, it may become necessary later to pull the spikes to remove the tie-plate shoulders from beneath the rail and to bring the outside shoulders into the desired position with relation to the base of the rail. A shoulder under the rail not only prevents a proper bearing for the rail, but creates a decided hazard of breakage of the rail base.

What Causes Paint to Crawl?

What causes the crawling or creeping of paint? How can it be prevented?

A Cold-Weather Defect

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ont.

The crawling or creeping of paint is usually a cold-weather defect which results from application to a surface that is much colder than the paint, chilling it and retarding the process of "setting up." This trouble can be overcome by using care to insure that the paint and the surface to which it is to be applied are at about the same temperature.

Sometimes the sagging of paint is referred to as creeping, but sagging, which is usually caused by the application of too heavy a coat, is not true creeping. There is always a tendency to apply paint too thick, particularly in cool weather when it is harder to brush out to a thin coat. As a consequence, if turpentine is not added to facilitate the brushing the paint is quite likely to sag.

Since so much painting has been deferred in recent years it is possible that, in an effort to bring painting back to normal, there may be a tendency to sacrifice quality of workmanship to speed. This should be guarded against diligently, for where painting has been neglected, the surface to be covered will have been affected by weathering to the extent that a greater effort will be required to put it in condition to receive the paint; otherwise, we can look forward to a deluge of defects common to inferior workmanship.

May Be Several Causes

By G. A. Rodman
General Supervisor of Bridges and Buildings, New York, New Haven & Hartford, New Haven, Conn.

There are several conditions under which paint is likely to crawl: (1) It may sag during application because of too thin a mixture, too heavy a coat or insufficient brushing; (2) it may occur in cold weather by reason of application to a cold surface and the chilling of the paint; (3) this is a condition known as wrinkling, where the surface in drying looks like embossed leather, because of too heavy a coat and insufficient brushing; (4) where paint is applied over a very hard glossy surface it will sometimes separate or crawl, leaving small bare spots as a result of insufficient bond.

Each case requires a different remedy, these being respectively: (1) A properly proportioned paint applied evenly and well brushed to a thin even coat; (2) apply only when the temperature is above freezing and the paint and the surface are at the same temperature; (3) lay the paint on in a thin even coat; well brushed out; and (4) sandpaper the surface or wash it with a strong soap, to remove the gloss, thus giving a surface that will hold the new paint.

Generally on Final Coat

By H. J. Cunniff
General Painter Foreman, Delaware & Hudson, Green Island, N. Y.

Crawling occurs usually on the finish or final coat. It can be caused by any one of the following conditions: (1) oil or grease accumulated on the surface prior to application of the first coat; (2) too much gloss on the previous or the first coat; (3) application to a damp or cold surface; or (4) inferior oil as the vehicle for the first coat.

Quite often the painter can prevent the crawling of the finish coat if he examines carefully the condition of the surface to be painted. If it contains grease or oil, he should clean it thoroughly before applying the first coat. Also, he should exercise care in making the application to insure that he does not leave this coat with a high gloss. To prevent this, he should thin his material for the first coat with turpentine, leaving a semi-gloss finish.

Crawling occurs occasionally in the finish coat in bridge painting. It may be caused by using a ready-mixed paint which is recommended to be used without thinning, in which event the first coat may be left with a high-gloss surface. Before applying the second coat the first coat should be allowed to remain exposed for a considerable time in order that the weather may remove the gloss from the surface.

In painting and lettering signs it is often required that they be finished with a very high gloss on both the background and the letters. To prevent crawling of the letters it is advisable to apply a very thin coat of bolted whiting or talcum powder to the surface beneath the letters. If crawling occurs while applying the final coat of varnish, it may be corrected by a light rubbing of No. 0 steel wool, after which it should be well sponged with a damp sponge, so that no particles of the steel wool remain on the surface, which might be picked up when applying the succeeding coat of varnish.

News of the Month

Railroad Employment in August Above Last Year

Class 1 railroads, excluding switching and terminal companies, had 1,162,797 employes on their payrolls as of the middle of August, an increase of 72,312, or 6.6 per cent, as compared with August, 1936, according to the Interstate Commerce Commission's compilation, based on preliminary reports. There was, however, a slight decrease in the number of employes as compared with July, 1937. The index of railroad employment, which is based on the 1923-25 average as equalling 100, stood at 65.1 for August, compared with 65.7 for the previous month and 61.0 for August, 1936.

Locomotive Shipments for Six Months Show Increase

A total of 185 locomotives, including 4 steam locomotives purchased abroad, were shipped from the plants of the principal domestic commercial builders during the first half of this year, as compared with 27 and 102 locomotives shipped during the corresponding halves of 1936 and 1935, respectively, according to statistics compiled by the United States Department of Commerce. The shipments for the first half of this year included 169 steam and 16 Diesel-electric locomotives. Unfilled orders as of June 30 totaled 372 units, consisting of 325 steam, 27 electric, and 20 Diesel-electric locomotives (including 2 steam-electric units. Of these, 40 steam and one electric locomotive were marked for foreign buyers.

I.C.C. Head Advocates One Big Railroad System

The suggestion that the problems of the railroads could be solved by consolidating them into one large system was advanced by Carroll Miller, chairman of the Interstate Commerce Commission, in an address before the National Association of Railroad and Utilities Commissioners at Salt Lake City, Utah, on August 31. "The logical solution of the railroad difficulties," he said, "seems to be one national railroad system. Such a system should result in a simple rate structure, no differently rated territories, uniform tariff classification, transportation wastes reduced to a minimum, and many other manifest benefits. By whatever equitable means one national railroad system might be accomplished, the security owners generally should ultimately be in a better position than under present competitive and complicated conditions." He said that he was "confident that a fair plan can be worked out to have all the rail carriers operated as one system if there becomes sufficient public interest in and demand for such procedure."

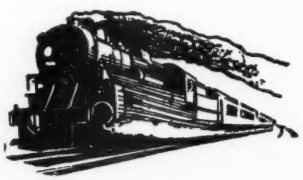
Big Four Foremen Meet

The Association of Maintenance of Way Foremen of the Cleveland, Cincinnati, Chicago & St. Louis (the Big Four) held its fifteenth annual convention at the Coronado hotel, St. Louis, Mo., on August 27-28. In addition to the discussion of committee reports on the Installation of N.Y.C. switches; the Selection and Training of Men; and on the Raising of Main Track Out-of-Face, the meeting was addressed by E. J. Bayer, division engineer of the Peoria & Eastern, on the Foreman of Tomorrow; by Armstrong Chinn, chief engineer, Alton, on Safety; and by H. R. Clarke, engineer maintenance of way, Chicago, Burlington & Quincy, on Meeting the Demands of Today and Tomorrow. The technical phase of the meeting concluded with a banquet on the evening of August 27 at which Elmer T. Howson, editor of *Railway Engineering and Maintenance*, spoke on This Industry of Ours. More than 160 foremen attended.

Opposes Provision of Train-Limit Bill

Opposition to the train-limit bill, which was passed by the Senate at the last session of the Congress, has been expressed by Chairman Lea of the Committee on Interstate and Foreign Commerce of the House of Representatives, who termed the bill "arbitrary." Chairman Lea's opinion concerning the bill, which was manifested in remarks appearing in the appendix of the Congressional Record, is important in view of the fact that he is chairman of the committee which will take the Senate bill under advisement at the next session of Congress.

"Manifestly," he said, "the question of what length train can be operated with proper regard to safety of employes and the public depends upon a number of factors, including the condition of the track, the grades, curves, safety equipment, the signal systems between the head and rear of the train, the brakes, speed, coupling equipment, visibility, and climatic conditions. The proposed law that would definitely fix the limit on train lengths, regardless of the variable factors that determine what length of train may be operated with safety, is arbitrary and seems to fail to provide that degree of regulation that safety, with due regard to proper operation, would require." Chairman Lea urged that the Interstate Commerce Commission be given the power to fix train limits after hearings and a thorough investigation of the subject.



D & R.G.W. Employees Hold Third Annual Purchase Week

Sponsored by the Ship and Travel By Rail Club of the Denver & Rio Grande Western, the third annual Rio Grande Employees' Purchase Week was held during the period from August 25 to September 2, inclusive. The purpose of this event is to impress Denver merchants and other business men with the importance of the purchasing power of the railroad and its employees. During the week the employees of the railroad carried cards which were given to merchants when purchases were made. The cards this year contained information showing the system payroll for the twelve months ended June 30, 1937, the Colorado and Denver payrolls for the same period, the purchases of coal, material and supplies in Colorado during the calendar year 1936, and the Colorado general and miscellaneous state taxes paid by the railroad during the same year. The card also told the merchant that the purchases of the employee are a reminder of the value of the railroad payroll, taxes and purchases to the state, the city and the merchant himself.

Carriers Can Reduce Expenses, Says Engineer

"There is no good reason why the majority of the railway chief executives, with constructive, rather than destructive, legal, security owner, financial, and governmental assistance, cannot solve the existing legislative and labor problems, and give the traveling and shippig public, as well as the security owners, the protection to which they are entitled," said John E. Muhlfeld, well-known railroad mechanical engineer, in a long letter to the Wall Street Journal. Substantial reductions in expenses can be accomplished by the carriers, said Mr. Muhlfeld, through a reduction in supplementary locomotive mileage, by the substitution of modern locomotives and rolling stock for obsolete units, by reducing the total net rental paid for locomotives, cars, and joint facilities, by eliminating unnecessary switching expense, by reducing the amount of cross-hauling and circuitous routing of both loaded and empty cars, by more efficient loading of freight cars, through the modernization of obsolete and inadequate locomotive and car repair and dispatching facilities, machinery and tools, and by the use of longer rails.

WOODINGS RAIL ANCHOR

WOODINGS ANCHORS are oil quenched and heat treated in ultra-modern electrically controlled furnaces and the finished product is checked continuously for fit, holding power, and conformance to specifications.

W

MILLIONS IN USE

THE WOODINGS RAIL ANCHOR is an economical investment. When specifying provide enough for absolute anchorage, do not under anchor.

WOODINGS FORGE & TOOL CO.
VERONA, PA.

Association News

Wood Preservers Association

President H. R. Duncan has called a meeting of the Executive committee at the Hotel Stevens, Chicago, at 10 o'clock on Tuesday forenoon, October 19.

Bridge and Building Association

Supplementing the program for the forty-fourth annual convention of the American Railway Bridge and Building Association that was published in the September issue, page 626, arrangements have been made for S. T. Bledsoe, president, Atchison, Topeka & Santa Fe System, Chicago, to address the association at its luncheon at 12:30 o'clock on Wednesday noon. Also on Thursday afternoon, arrangements have been made for the members to inspect the plant of the Crane Company. Members will be taken to this plant immediately after the adjournment of the final session late Thursday forenoon, and, after luncheon at the plant, will be afforded an opportunity to inspect the manufacture of water service fittings and other products of that company used by railroads.

American Railway Engineering Association

On September 22, certain proposed revisions to the constitution of the association were sent to all members for letter ballot. The principal change provides that the secretary and treasurer shall be appointed by the Board of Directors, instead of being elected as at present. With some minor exceptions, the remaining revisions are a matter of wording and arrangement.

The Board of Directors has conferred honorary membership on J. L. Campbell, C. A. Morse, W. B. Storey and J. G. Sullivan, all past presidents of the association. Certificates of honorary membership will be presented to them at the opening session of the convention next March.

Pages containing revisions to the Manual that were approved at the last convention, will be ready for mailing to holders of the Manual shortly after October 1.

Three committee reports are now in the hands of the secretary, and four other committees have promised to submit their reports by the first week in October. The Board has outlined a plan for publishing committee reports which will group all related subjects and whereby these reports will be presented at the convention in the order of publication. Since this plan requires close cooperation of all committees and marked changes in the schedule of some, it is not expected that the plan can be carried out completely this year.

Thirteen committees met in September, including Buildings, at Toronto, Ont., on September 8 and 9; Standardization, at Chicago, on September 13; Wood Bridges and Trestles, at Urbana, Ill., on September 14; Highways, at Chicago, on September 14; Electricity, at Chicago, on September 14; Maintenance of Way Work Equipment, at Chicago, on September 14 and 15; Rail, at Chicago, on September 15; Track, at Chicago, on September 15; Economics of Railway Location, at Chicago, on September 15; Masonry, at Chicago, on September 22 and 23; Records and Accounts, at Washington, D. C., on September 23; Roadway, at Chicago, on September 28; and Water Service, Fire Protection and Sanitation, at Chicago, on September 28.

Eight committees have already scheduled meetings during October, as follows: Yards and Terminals, at Toledo, Ohio, on October 4 and 5; Economics of Railway Labor, at St. Louis, Mo., on October 6, followed by an inspection of the improvements made several years ago on the St. Louis Southwestern; Iron and Steel Structures, at Chicago, on September 7 and 8; Rules and Organization, at Chicago, on October 8; Uniform General Contract Forms, at New York, on October 11; Waterways and Harbors, at Chicago, on October 12; Wood Preservation, at Chicago, on October 22; and Ballast, at Washington, D. C., on October 22.

Bridge and Building Supply Men's Association

A total of 37 companies have arranged to date to exhibit their products at the convention of the American Railway Bridge and Building Association, which exhibit will be presented at the Hotel Stevens, Chicago, on October 19-21, coincident with the convention of that organization. The companies which have arranged for space since the appearance of the September issue include the following:

Automatic Nut Company, Chicago
Celotex Corporation, Chicago
Crane Company, Chicago
B. E. Hurlbut, Chicago

Further applications for space at this exhibit should be sent to W. S. Carlisle, secretary, National Lead Company, 900 West 18th street, Chicago.

Our Car Ferries Largest in World

"The railroads of this country are today operating the most extensive car-ferry systems in the world," says a recent statement issued by the Association of American Railroads, which goes on to say that the car-ferry operations of the railroads are carried on "with virtually the same regularity of performance that marks their other services." More than 2,000 pieces of floating equipment, including steamers, tug boats, car floats, barges, lighters and miscellaneous units are owned by the railroads, which employ a sizeable army of marine workers. Car ferries are operated by the railroads for the most part for the transfer of freight cars, although there are a number of places where they are still used to transfer cars in passenger service.

Personal Mention

General

L. R. Lamport, assistant engineer on the Galena division of the Chicago & North Western, has been appointed supervisor of work equipment, and **H. Mayer,** chief scale inspector, has been appointed supervisor of scales, both with headquarters at Chicago. The position of chief scale inspector has been abolished. In their new positions Mr. Lamport and Mr. Mayer have each assumed a portion of the former duties of **C. E. Miller,** supervisor of scales and work equipment, whose appointment as assistant engineer of maintenance is noted elsewhere in this issue.

Engineering

H. E. Smith has been appointed division engineer of the Capreol division of the Canadian National, with headquarters at Capreol, Ont., succeeding **S. McIlwain,** transferred.

E. B. Fithian has resumed his duties as division engineer of the Wichita division of the Missouri Pacific, with headquarters at Wichita, Kan., relieving **P. P. Wagner,** who has been assigned to other duties.

Hurieosco Austill, who has been appointed chief engineer of the Mobile & Ohio, as reported in the September issue, was born on May 16, 1884, at Spring Hill, Ala. Mr. Austill received his engineering education at the University of Alabama, graduating in 1906, and later took a special course at Cornell university. He

Hurieosco Austill

entered railway service in October, 1901, as a rodman on construction on the Louisville & Nashville and later, during vacations from school, he served in engineering capacities with several railroads and the Republic Iron & Steel Company. On May 16, 1906, after his graduation, he became a resident engineer on railroad location and construction with the Mississippi Eastern, remaining with this company until August of the same year when he joined the Louisville & Nashville as

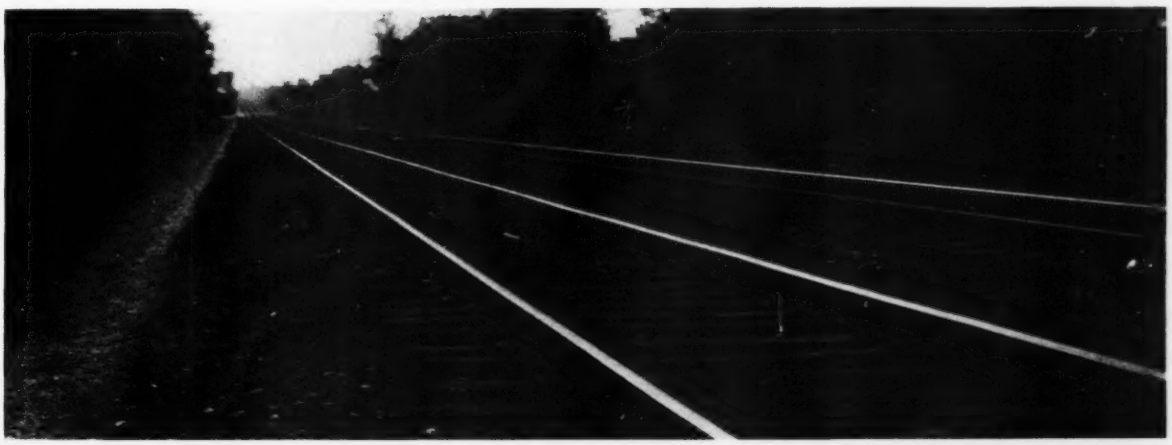
Now!

A Controlled Crown Conforming To Modern Surfacing Methods

Improved track conditions—lowered maintenance costs follow the installation of EVERTITES. This scientifically designed bar NOW has a controlled crown. Adjustment of end bolts at yearly inspection replaces any crown losses—low joints are eliminated. It is not necessary to space joint ties—regular plates and spiking through the joint are all that is required.

On many roads—over hundreds of miles of track EVERTITES have been installed and are proving highly successful, providing shockless joints—taking hard spots out of track—reducing joint maintenance—prolonging life of rails and equipment—proving themselves *the nearest approach to continuous rail.*

The high efficiency in design of today's EVERTITES is due to several years of rail joint and rail end research work with our special designated rail and rail joint micrometer instruments. We had to know the



facts in micrometer detail. We meet the extreme limits as found by this research. Our instruments are available without cost to any railroad desiring to make special rail joint and rail investigations and studies.

Two folders explaining some of the advantages of Evertite Rail Joints—"When Speeds Reach 100" and "Radical Improvements" will be sent to those interested in Railroads and track maintenance, on request.

STANDARD EQUIPMENTS, INC.
70 East 45th Street, New York
Chicago Office, 310 South Michigan Avenue

assistant resident engineer on the construction of double track at Birmingham, Ala. For two years beginning with August 11, 1908, he was with the United States Engineer Corps and was identified with a number of important construction and location projects. At the end of this period he became connected with the Mobile & Ohio as an assistant engineer on maintenance, holding this position until April 1, 1911, when he was promoted to bridge engineer. On September 2, 1917, Mr. Austill entered active service with the United States Army as captain of engineers, later being commissioned major of engineers. On January 1, 1919, following his discharge from the army he returned to the M. & O. as bridge engineer, which position he held until his recent appointment as chief engineer. Mr. Austill is active in the affairs of a number of engineering societies and is chairman of the Committee on Wooden Bridges and Trestles of the A.R.E.A. Also he is a colonel in the United States Army, Engineer Reserve, commanding the 327th Engineers.

W. J. Lank, division engineer on the Kansas City Southern, with headquarters at Pittsburg, Kan., has been transferred to the Kansas City Terminal division, with headquarters at Kansas City, Mo., succeeding **I. L. Hartzell,** who has been assigned to other duties.

R. C. Arnold, engineer of surveys of the Chicago Great Western, with headquarters at Chicago, has been appointed acting division engineer at Oelwein, Iowa, to succeed **H. E. Gardner,** whose death is noted elsewhere in these columns. **H. W. Smith,** chief timber inspector at Chicago, has been appointed engineer of surveys, with the same headquarters, to succeed Mr. Arnold.

C. W. Baker, assistant division engineer on the Lehigh Valley, with headquarters at Buffalo, N.Y., has been promoted to division engineer with the same headquarters, succeeding **J. F. Donovan,** who has been transferred to Easton, Pa. Mr. Donovan succeeds **R. E. Patterson,** who has been promoted to the newly-created position of assistant to the chief engineer, with headquarters at Bethlehem, Pa.

Gordon H. Beasley, assistant engineer on the Eastern Kentucky division of the Louisville & Nashville, has been promoted to division engineer of the same division, with headquarters at Ravenna, Ky., succeeding **A. F. Frendberg,** who has resigned. **Howard C. Forman,** assistant engineer on the Cumberland Valley division, has been promoted to assistant division engineer of the same division, with headquarters at Middlesborough, Ky.

George A. Belden, architect of the Central of Georgia, who has been promoted to engineer of bridges and buildings, with headquarters at Savannah, Ga., as reported in the September issue, was born on August 13, 1888, at Upper Montclair, N. J., and was graduated from Cornell University in 1912, with the degree of civil engineer. His first railway experience was with the Erie, in 1907, and in 1912, after his graduation from college, he entered the employ of the Central of Georgia, serving as a draftsman for two years, at the end of which time he was promoted to assistant engineer. In 1917, he was further advanced to architect, which position he held until his recent promotion.

W. H. Rochester has been appointed to the re-established position of district engineer of the Southern district, Western lines, Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex. This posion was last filled by **R. A. Rutledge,** who retired on September 1, 1932. Previous to his appointment, Mr. Rochester held the title of construction engineer, in which capacity he was in charge of the construction of the Santa Fe's recently completed line between Amarillo, Tex., and Las Animas, Colo.

Don A. Kuebler, who has been appointed division engineer of the Northern division of the Kansas City Southern, with headquarters at Pittsburg, Kan., as reported in the September issue, was born on May 7, 1888, at Waco, Neb. Mr. Kuebler received his higher education at Nebraska University, graduating in 1909 with a Bachelor of Science degree in electrical engineering. He entered railway service in January, 1910, with the Missouri Pacific, serving for a year on location and construction work in Nebraska and Kansas. In November, 1912, he entered the service of the Kansas City Southern and has been with this company continuously. From 1912 to 1917, he served as a rodman and transitman, and from the later year until July, 1925, he served as an assistant engineer on maintenance and construction and as a roadmaster. At the end of this period, Mr. Kuebler was appointed office engineer at Kansas City, which position he was holding at the time of his recent appointment as division engineer at Pittsburg.

Charles E. Miller, who has been appointed assistant engineer of maintenance of the Chicago & North Western, with headquarters at Chicago, as reported in the September issue, was born on January 25, 1883, at Adrian, Mo. Mr. Miller first entered railway service in June, 1902, and from that year until 1910, he attended the University of Nebraska intermittently while engaging in railroad construction and maintenance work. His first position in railroad work was in the track department of the Chicago, Burlington & Quincy. He first entered the service of the Chicago & North Western on June 10, 1903, in the engineering department at Sioux City, Iowa. In March, 1905, after a period at college, he returned to the North Western and for a time he engaged in maintenance work at Deadwood, S. D., later in the same year being assigned to duties in connection with the construction of a line from Pierre, S. D., to Rapid City. On the completion of this project Mr. Miller was sent to Omaha, Neb., where he engaged on maintenance work until September, 1908, when he returned to college. During the following year he was engaged on location surveys for the North Western in South Dakota. Early in 1910, after completing his course in civil engineering at college, he returned to the North Western as assistant engineer on the construction of new lines, engaging on this work until April, 1913, when he was assigned to the chief engineer's office as assistant engineer. In May, 1915, he was promoted to assistant general bridge inspector and in November, 1919, he was appointed supervisor of scales. In March, 1926, he was also given supervision over work equipment with the title of supervisor of scales and work equipment, which position he was holding at the time of his recent promotion.

Joseph B. Maddock, whose retirement from active service as engineer bridges and buildings, on the Central of Georgia, with headquarters at Savannah, Ga., was reported in the September issue, had been connected with this company for 34 years. He was born on March 19, 1866, at Savannah, and received his education at the Savannah High school. He entered railway service in January, 1880, with the Plant System of Railways, as rodman, later serving consecutively as draftsman, assistant engineer and bridge engineer until its absorption by the Atlantic Coast Line in 1902. Mr. Maddock was then an assistant engineer on the Atlantic Coast Line until April, 1903, and then until his retirement in July, 1937, was bridge engineer and engineer bridges and buildings on the Central of Georgia with headquarters at Savannah.

Henry E. Smith, assistant division engineer on the Canadian National, with headquarters at Allandale, Ont., has been promoted to division engineer, with headquarters at Capreol, Ont., succeeding **S. McIllwain,** who has been assigned to other duties. Mr. Smith was born on May 4, 1894, at Ottawa, Ont., and received his higher education at McGill University, graduating in 1917, with the degree of B. Sc. Prior to entering railway service in 1917, Mr. Smith was with the Geodetic Survey of Canada. On May 1, of that year, he went as an instrumentman to the Grand Trunk and subsequently served from 1919 to 1928 as assistant engineer on the Grand Trunk and its successor, the Canadian National. He served from March, 1928, to November, 1931, as division engineer on the C.N.R., at Richmond, Que., and on the latter date was appointed assistant division engineer, with headquarters at Allandale, which position he held until his promotion on August 23 to the position of division engineer, with headquarters at Capreol.

Track

William Melchert has been appointed division foreman of buildings on the Michigan Central, with headquarters at Jackson, Mich., to succeed **S. B. Jones,** retired.

J. L. Hendrix has been appointed roadmaster on the St. Louis-San Francisco, with headquarters at Springfield, Mo., to succeed **W. S. Harrison,** who has been assigned to other duties.

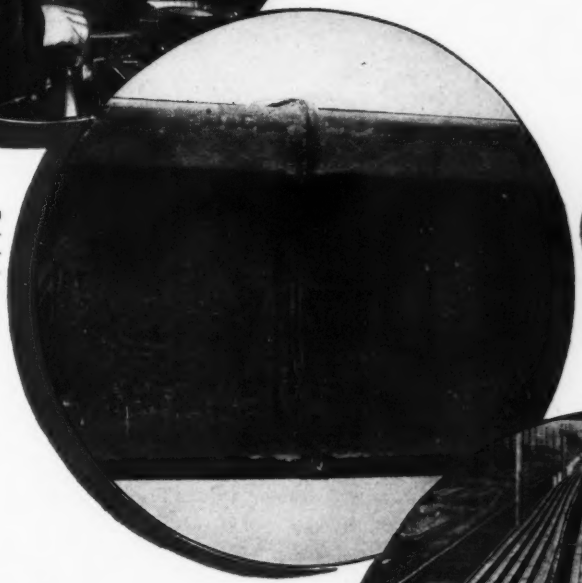
N. W. Baxter, assistant roadmaster on the Chicago, Rock Island & Pacific in charge of a rail-laying gang, has been appointed acting roadmaster at Peoria, Ill., to succeed **W. E. Haberlaw,** who has been granted a leave of absence. **S. P. Jones,** roadmaster on the Oklahoma division with headquarters at Wichita, Kan., has been transferred to the Missouri-

FLASH BUTT WELDING OF RAILS

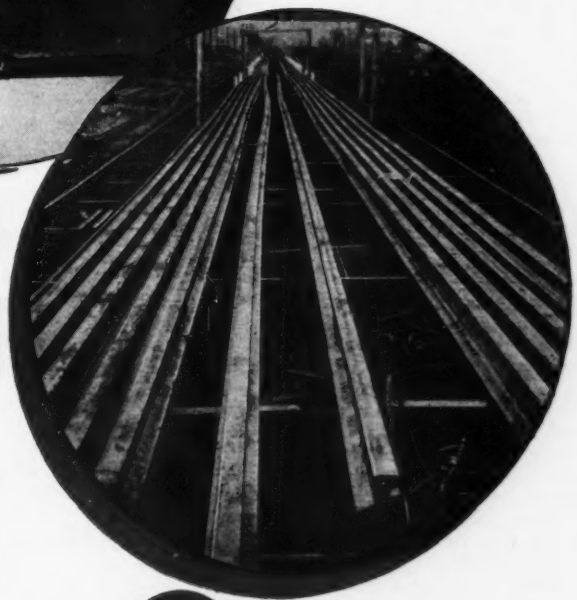
by Sperry

1

Rails gripped in welding machine—ends brought together—electric current applied—pre-heated—flashed—pushed up.



The Flash Weld—pure original metal of the rail throughout—upset metal is ground off to make a neat sound joint.



3

Rails welded in any convenient length. 12 strings of 39' rail, welded into 1000' lengths, being transported from yard for distribution alongside track.

45 Miles of Welded Rail

flash welded by Sperry

is included in the 1937 rail laying program of the Delaware and Hudson Railroad Corporation.

Sperry welded rail, fed onto flat cars, on yard track, is easily transported to points of laying.

SPERRY RAIL SERVICE

Brooklyn, N. Y. Chicago, Ill.

Kansas division, with headquarters at St. Joseph, Mo., to succeed **D. W. Bickett,** who has been transferred to the Western division, with headquarters at Fairbury, Neb. Mr. Bickett replaces **C. H. Hardwick,** who has been transferred to Wichita, to replace Mr. Jones.

W. H. Johnson has been appointed acting roadmaster on the Ruel subdivision of the Canadian National, with headquarters at Capreol, Ont., succeeding **E. Haystead,** who has been granted leave because of illness.

George J. Goolic, general track foreman on the Staten Island Rapid Transit Lines of the Baltimore & Ohio, has been promoted to supervisor of track, with headquarters at St. George, Staten Island, succeeding **William Ryan,** who has been retired from active service.

W. C. Peters has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Newton, Kan., succeeding **A. N. Ferguson,** who has been transferred. Mr. Peters will have jurisdiction over the Strong City, Salina and Minneapolis districts of the Middle division.

C. S. Collier, a rodman on the Springfield division of the Illinois Central, with headquarters at Clinton, Ill., has been promoted to supervisor with the same headquarters, to succeed **P. R. Henderson,** who has been transferred to Litchfield, Ill., where he replaces **J. Schwartz,** who has been transferred to Chicago, to succeed **M. J. Connerton,** who has retired.

James T. Peabody, assistant roadmaster on the Wisconsin division of the Chicago & North Western, who has been promoted to roadmaster on Sub-division No. 8 of the Dakota division, with headquarters at Tracy, Minn., as reported in the September issue, was born on August 30, 1908, at Evanston, Ill. He entered railway service with the North Western on May 9, 1932, as an air compressor operator, being promoted to assistant foreman on November 21, 1932. On June 16, 1933, Mr. Peabody was further promoted to section foreman and on November 25, 1934, he was advanced to assistant roadmaster, the position he was holding at the time of his recent appointment, which was effective on August 23.

V. R. Lukoskie, a trackmaster on the Alton, with headquarters at Bloomington, Ill., has been promoted to supervisor of track with the same headquarters, to succeed **J. P. Corcoran,** who retired on September 1 after 51 years service with this company. **W. J. Driscoll,** an extra gang forman, has been promoted to trackmaster at Bloomington, to succeed Mr. Lukoskie.

Mr. Corcoran was born on February 17, 1865, at Joliet, Ill., and entered railway service with the Alton on March 1, 1886, as a yard clerk. Subsequently he was advanced to section foreman and in 1908 he was promoted to supervisor of track, with headquarters at Jacksonville, Ill. In 1909 Mr. Corcoran was appointed roadmaster, returning to the position of supervisor in 1910. Four years later he was again appointed roadmaster, which position he held until 1932, when he was appointed supervisor. Mr. Corcoran is a past president of the Roadmasters and Maintenance of Way Association of America (1922-23) and of the Maintenance of Way Club of Chicago (1931-32).

Albert L. Ray, who has been appointed supervisor of track on the Grand Trunk Western, with headquarters at Detroit, Mich., as announced in the September issue, was born on March 14, 1900, at Atlanta, Ga. He first entered railway service in November, 1917, as a rodman on the Louisville & Nashville at Nashville, Tenn. His connection with the Grand Trunk Western dates from August 21, 1920, when he entered the service of this company as a rodman at Detroit. Subseqeuntly he served as a draftsman and instrumentman, and on February 16, 1923, he was promoted to assistant engineer at Durand, Mich., which position he held until September 1, 1932, when that position was abolished. From that time until his appointment as supervisor of track, he served as an instrumentman at Detroit.

Frank C. Hajek, assistant roadmaster on the Chicago & North Western, with headquarters at Boone, Iowa, who has been promoted to roadmaster of Subdivision No. 2 of the Sioux City division, as reported in the September issure, has been in the service of this company for 25 years. He was born on May 18, 1898, at Chicago, and after a public school education he took an engineering course through the International Correspondence Schools. He entered the service of the North Western on September 3, 1912, as a clerk at the State Street freight station at Chicago. Four years later, Mr. Hajek transferred to the engineering department where he was advanced successively through the positions of tapeman, rodman, construction accountant, draftsman, instrumentman and assistant roadmaster. He is now located at Wall Lake, Iowa.

John Roszak, who has been appointed roadmaster of Sub-division No. 1 of the Sioux City division of the Chicago & North Western, as announced in the September issue, was born on August 24, 1896, at Ironwood, Mich., and after a public school education, he continued his studies through the Railway Educational Bureau. He entered railway service with the North Western on May 10, 1910, as a section laborer, being advanced to assistant section foreman in 1913 and thence to section foreman in 1914. During the following 20 years, Mr. Roszak alternated between the positions of section foreman and extra gang foreman at various points, being at the end of this period promoted to assistant roadmaster. He was holding this position at the time of his recent appointment as roadmaster, which became effective on August 19.

Bridge and Building

Oscar L. Griffin, a bridge and building foreman on the Cleveland, Cincinnati, Chicago & St. Louis, who has been promoted to bridge and building supervisor, with headquarters at Washington, Ind., as reported in the September issue of *Railway Engineering and Maintenance*, has been connected with this company for 38 years. He was born on July 25, 1887, at Eubanks, Ky., and first entered the service of the Big Four on September 3, 1899, as a lamp tender. From 1901 to 1910 he worked as a section laborer and for the following two years he was connected with the bridge and building department as a laborer. In 1912, Mr. Griffin was made a bridge and building carpenter, and after five years in this capacity, he was promoted to assistant bridge and building forman. From 1918 until his recent appointment as bridge and building supervisor, he served as a bridge and building foreman.

D. M. MacKenzie, bridge and building master on the Calgary division of the Canadian National, has been transferred to the Edmonton division and **A. Crawford,** bridge and building master, has had his jurisdiction extended to include the territory over which Mr. MacKenzie formerly had supervision.

Obituary

Walter Constance, supervisor of reclamation of the Chesapeake & Ohio, with headquarters at Barboursville, W. Va., died on September 10 following a stroke.

H. E. Gardner, division engineer on the Chicago Great Western, with headquarters at Oelwein, Iowa, died on September 10 as the result of injuries incurred in an automobile accident.

Thomas J. F. King, assistant district engineer on the Canadian National, with headquarters at Quebec, Que., died on August 17, after several months' illness, at the age of 56. Mr. King was born in Everton, England, and was graduated from Glasgow Technical College, following which he practised mining engineering in Scotland. He came to Canada in 1905, and after working for a time for the Mond Nickel Company, at Sudbury, Ont., he entered the employ of the Canadian Pacific Railway, and subsequently left that road to accept an engineering position on the Canadian National Railways, at Moncton, N.B. Later, he was promoted to the position of assistant district engineer at Quebec, the position he was holding at the time of his death.

Charles L. Wieand, supervisor of track on the Reading, with headquarters at West Milton, Pa., died suddenly on August 28. Mr. Wieand was born on September 20, 1900, at Reading, Pa., and received his education at the Lansdale grammar and high school, the University of Pennsylvania and Penn State College, receiving from the latter a degree in civil engineering. He entered railway service with the Reading on June 15, 1922, as a laborer, and the following month became a clerk in the chief engineer's office, at Philadelphia, Pa., which position he held until October 10, 1923, when he became a levelman at Reading. The following November, Mr. Wieand was promoted to assistant supervisor, with headquarters at Tamaqua, Pa., and held this position until May 16, 1925, when he was made yardmaster, with the same headquarters. On February 1, 1926, Mr. Wieand left Tamaqua to become mechanical supervisor at

This Hayes Type WD Bumping Post is a carefully designed structure erected on the sturdy foundation of a track doubled in strength by middle rails

Type WD weighs less than the old-style posts. This lighter weight is chiefly due to the absence in WD of a big cast-iron head; add such a head and WD will weigh about the same as the others. There is a vague idea in the minds of some that this big head absorbs the shock. But such a head weighs only one-half of one percent of an average car and its shock-absorbing capacity is negligible. Instead of an easily fractured cast-iron head, WD has a head of tough rolled steel, adapted to take repeated blows without damage. It is designed, not to absorb the shock in itself, but to receive the shock and carry it through the tension and compression members to the track and earth.

Hayes Track Appliance Co., Richmond, Indiana

Philadelphia, and on March 1, 1929, he was sent to Birdsboro, Pa., to become yardmaster at that point. On June 1, 1932, he was appointed assistant supervisor, with headquarters at Philadelphia and on October 1, 1935, he was promoted to supervisor of track, with headquarters at Reading, being transferred to West Milton on September 16, 1936, where he remained until the time of his death.

Russell L. Huntley, who retired on December 31, 1927, as chief engineer of the Union Pacific, died on September 1 at Los Angeles, Cal., at the age of 80 years. Mr. Huntley was born in New York and was graduated from Rensselear Polytechnic Institute in 1880. In the same year he entered railway service as an engineer on construction for the New York Central & Hudson River (now part of the New

Russell L. Huntley

York Central) and for a number of years following he acted as division engineer on maintenance and new construction. On July 1, 1886, Mr. Huntley entered the service of the St. Joseph & Grand Island as a location engineer on new construction in Nebraska, where he remained until August 1, 1888, when he became an assistant engineer on the Union Pacific in charge of locomotive shop construction. During the period from January, 1890, to June, 1899, his time was devoted to bridge construction and the location and construction of new lines. Mr. Huntley was then promoted to principal assistant engineer of the U. P., with headquarters at Omaha, serving in that capacity until February 1, 1905, when he was appointed acting chief engineer of the Union Pacific Railroad. In September of the following year his title was changed to chief engineer and in August, 1918, he was promoted to chief engineer of the Union Pacific System.

Tapes and Rules—The complete line of tapes and rules manufactured by the Lufkin Rule Company, Saginaw, Mich., is described in a 48-page pocket size catalog recently issued by this company.

Portable Gasoline Hammer—The applications and mechanical features of the Barco portable gasoline hammer are described in an eight-page bulletin which is being distributed by the Barco Manufacturing Company, Chicago.

Supply Trade News

General

The Stulz-Sickles Company, Newark, N.J., has appointed as its distributor the **Oliver H. Van Horn Company, Inc.,** New Orleans, La., which has branches at Houston, Tex., and Shreveport, La.

The Linde Air Products Company, unit of the **Union Carbide and Carbon Corporation,** has opened a sales office in Oakland, Cal., at 3710 San Pablo avenue. This company has moved its Boston district office to 44 Stuart Street, Boston, Mass.

The Wrought Washer Manufacturing Company, Milwaukee, Wis., is celebrating the fiftieth anniversary of its founding. When organized in 1887 as the Nut & Washer Manufacturing Company, it was prepared to produce a ton of washers a day. In the half century that has intervened, its capacity has been increased to 70 tons of washers a day consisting of many sizes and shapes.

Obituary

Clarence E. Irwin, a sales agent at St. Louis, Mo., for a number of railroad supply companies, died at that point on August 25 after a brief illness. He represented the American Fork & Hoe Company, the Lundie Engineering Corporation, the Nordberg Manufacturing Company and the Railway Utility Company.

Trade Publications

Corrugated Transite—The applications and advantages of corrugated transite are discussed in a 12-page illustrated booklet recently published by Johns-Manville, New York.

Ruggedwear Resurfacer.—The Flexrock Company, Philadelphia, has issued a four-page folder describing and illustrating the application of Ruggedwear in installing, resurfacing or patching platforms and building floors of various types. The folder also explains the engineering service offered by the company in solving flooring repair problems.

Maintenance of Surfaces—The Skybryte Company, Cleveland, Ohio, has issued a 14-page illustrated catalog which is devoted to a discussion of the materials for surface application that are manufactured by this company. These include paints, caulking compounds, glass cleaner, rust solvents, a material for application directly over rust and roof primers, coatings and patching cement.

Welding of Wrought Iron—A complete discussion of the various factors entering into the welding of wrought iron is contained in a 12-page pamphlet bearing this title, which is being distributed by the A. M. Byers Company, Pittsburgh, Pa. Pertinent information on the manual welding of plates of various thicknesses is given in tabular form, while another table gives the recommended rate of travel of the electrodes (manual metal arc-welding) in inches per minute.

Crawler Tractors—The Model AG Cletrac crawler tractor is the subject of a 28-page bulletin recently published by the Cleveland Tractor Company, Cleveland, Ohio. The bulletin is profusely illustrated with photographs and drawings, including many sectional views showing mechanical details of the tractor.

Bucyrus-Erie Scrapers—Two four-page folders describing the four-wheel and two-wheel scrapers manufactured by the Bucyrus-Erie Company, South Milwaukee, Wis., and known as Bulletins 4WS1 and 2WS1, respectively, have been published by this company. Noteworthy features of the scrapers are described by both text mater and photographs.

Joint Connectors—Photographs of railroad structures in which they have been used, drawings showing methods of application and pictures of the connectors themselves are the salient features of an eight-page bulletin issued by the Timber Engineering Company, Washington, D. C., that explains the use of Teco connectors. The trademarks of 11 railroads that have used these connectors are reproduced on the front covers.

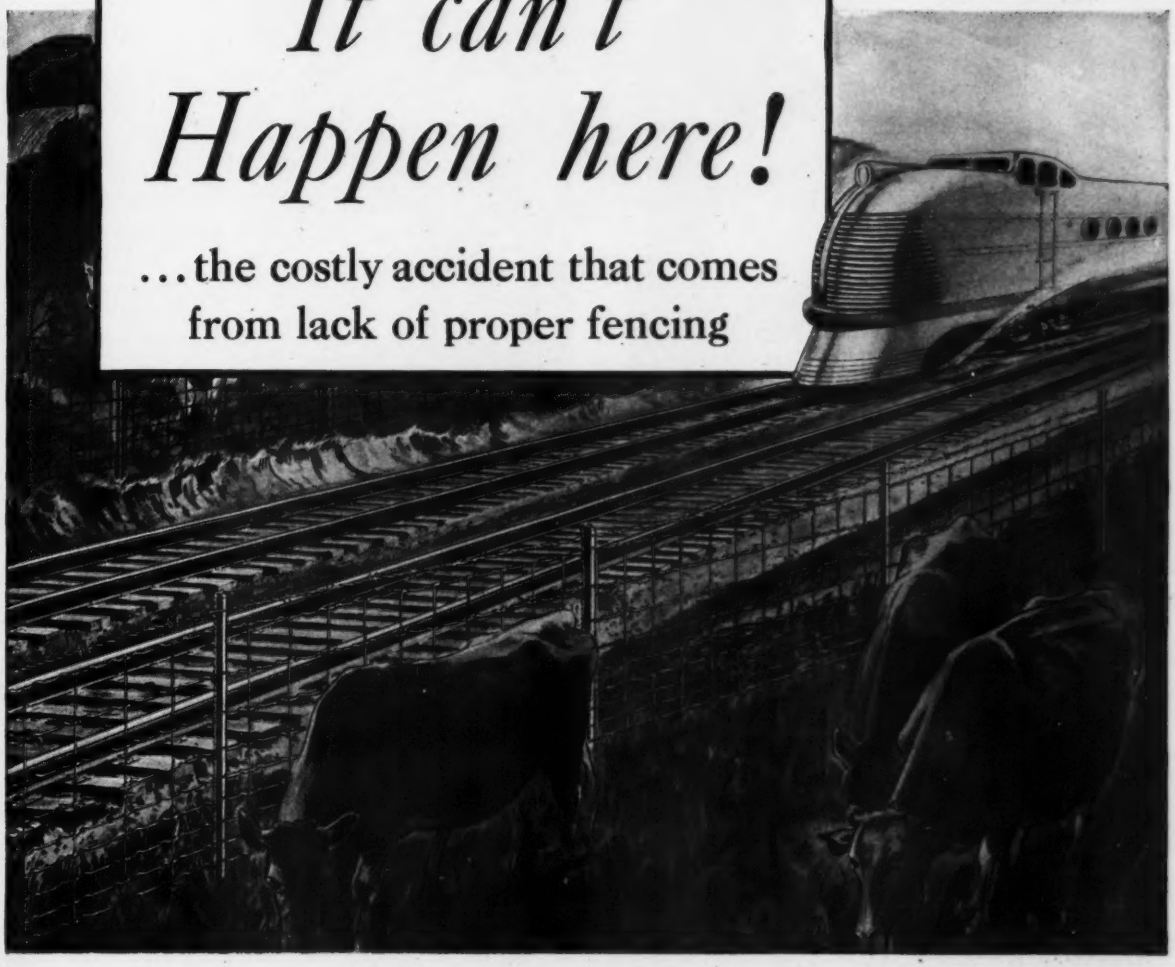
Marching On with Industry—This is the title of a 12-page illustrated booklet published by the Industrial Brownhoist Corporation, Bay City, Mich., which covers this company's complete line of Diesel and gasoline locomotive cranes, ranging in capacities from 10 to 50 tons. Included in the booklet are views showing the cranes engaged in all kinds of bucket, hook and magnet work, as well as technical matter describing the important features of their construction.

How to Buy Culverts—This is the title of a reference booklet concerning culverts and culvert materials, their cost and practical application, which is being distributed by United States Steel Corporation Subsidiaries, Pittsburgh, Pa. Containing 24 pages, the bulletin is profusely illustrated. It discusses the features of metal that make it an ideal material for culverts; it also contains text matter on part-circle culverts, perforated metal culverts and on the advantageous features of copper steel. Five pages of tables contain essential design information.

Water Works Manual—This is the title of a 120-page illustrated book recently issued by the Youngstown Sheet & Tube Company, Youngstown, Ohio. While devoted primarily to this company's special wrapped and lined steel water mains, the manual cotains a large amount of technical information on the design, construction and maintenance of water mains. The manual has been issued in loose-leaf form, with permanent binder, to facilitate the addition of pertinent facts on various types of pipe, fittings, laying methods, and other data, which additions will be sent out from time to time. It is featured by tables and charts containing basic hydraulic information and engineering data used in water main flow capacity and pipe-line computations.

It can't Happen here!

...the costly accident that comes from lack of proper fencing



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United States Steel Products Company, New York, *Export Distributors*

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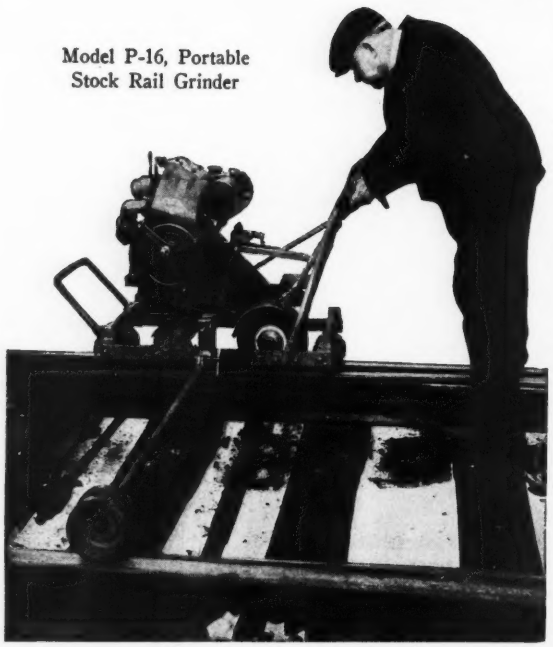

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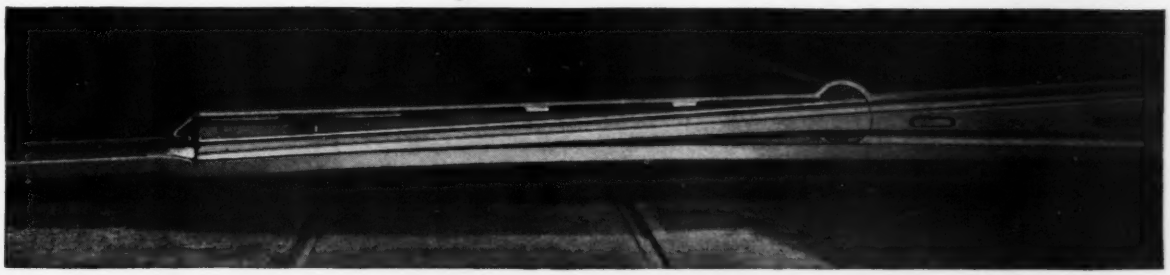

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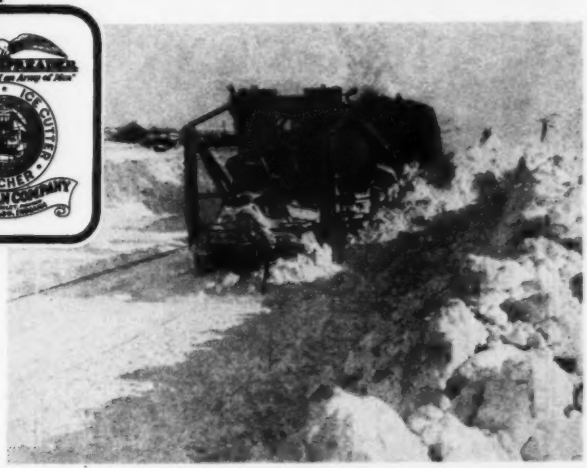

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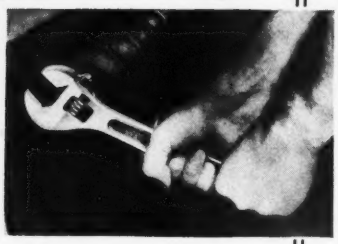

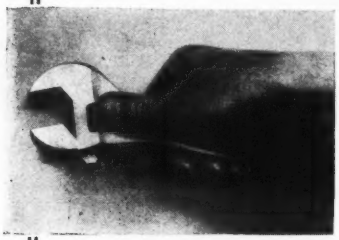

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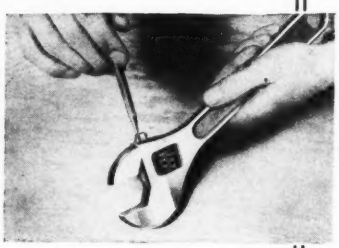

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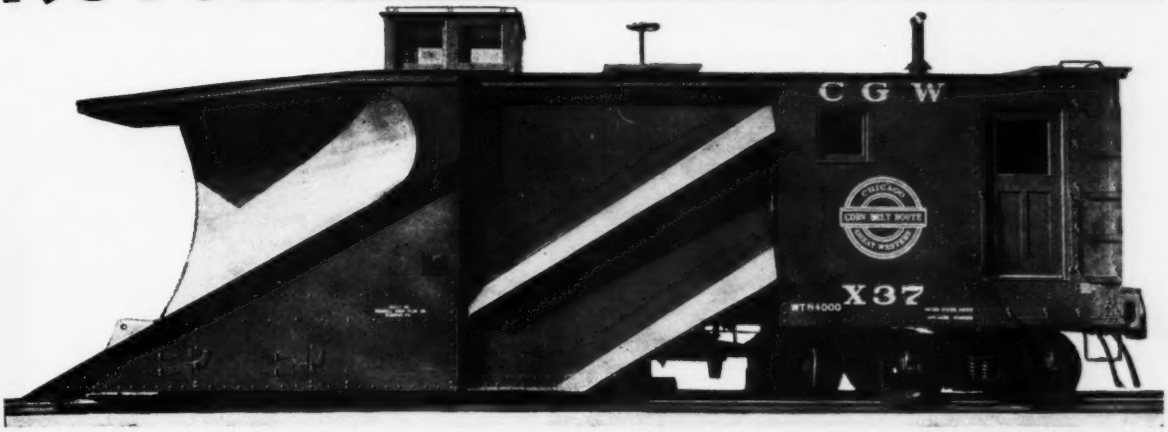

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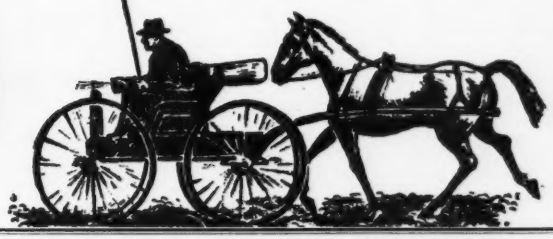

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TO AVOID UNNECESSARY LOSSES *ROOFS SHOULD COME FIRST*
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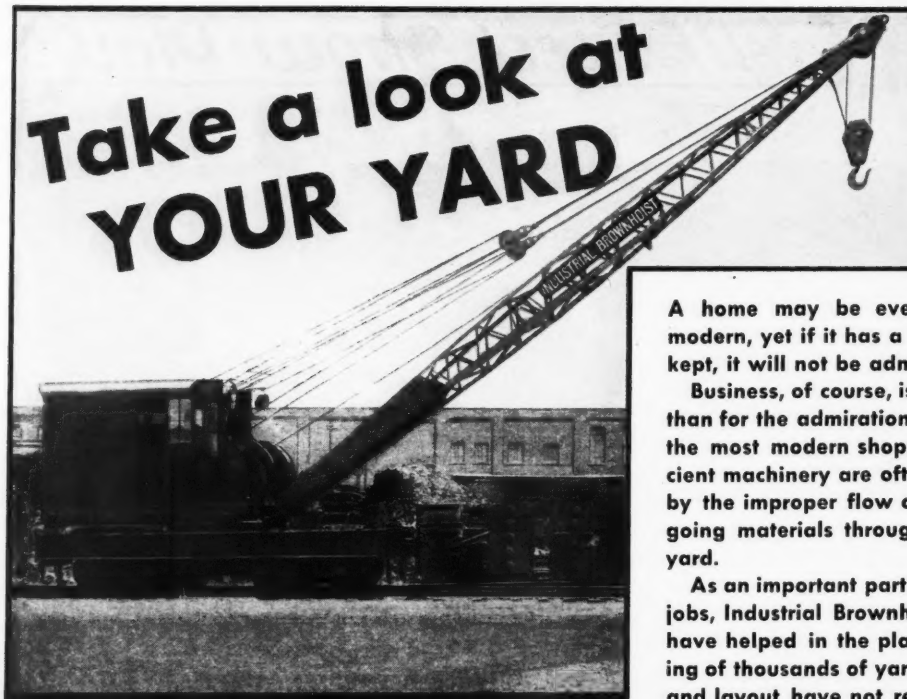

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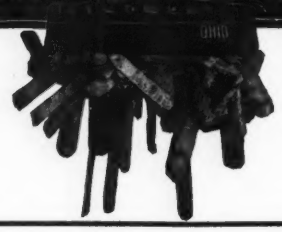

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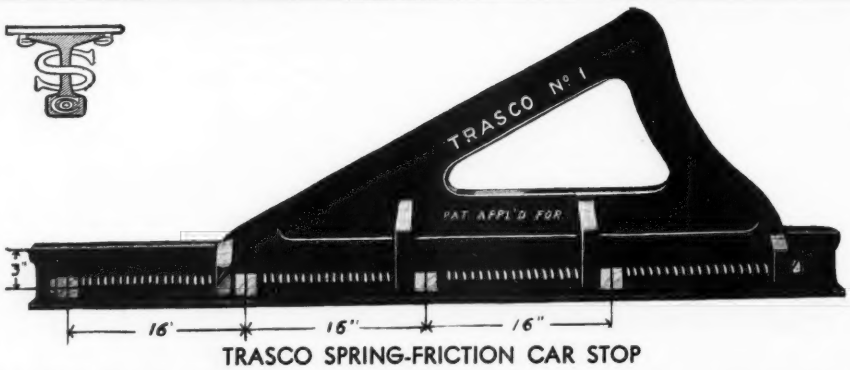

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American Fork & Hoe Co., The.....685
Cleveland, Ohio.
Ballast Forks; Hoes; Rail Anchors; Rail Anti-Creepers; Rail Fork; Rail Shims; Scuffle Hoes; Shovels; Stone Hook; Two Man Rake.

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See Koppers Co.

American Steel & Wire Company.....652-653-751
See U. S. Steel Corporation Subsidiaries.

Ardco Manufacturing Co......668
1 Newark St., Hoboken, New Jersey.
Rail and Flange Lubricators.

Armco Culvert Manufacturers Association.....661
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Barco Manufacturing Company.....682
1805 Winnemac Ave., Chicago, Illinois.
Gasoline Hammers; Tie Tampers.

Bartlett Hayward Division of Koppers Co......663-664-665-666
See Koppers Co.

Bethlehem Steel Company.....646-681
Bethlehem, Pennsylvania.
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Carnegie-Illinois Steel Corp......652-653-751
Carnegie Building, 434 5th Avenue, Pittsburgh, Pennsylvania.
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310 South Michigan Avenue, Chicago, Illinois.
Rust Preventive; Water Treatment.

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Pittsburgh, Pennsylvania.
Jacks, Automatic Lowering, Horizontal, Lifting, Pipe Forcing, Pull, Push, Special Purpose, Track; Tie Spacers.

Eaton Manufacturing Co......644
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Elastic Rail Spike Corporation.....753
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Rail Spikes; Spikes Rail.

Fairbanks-Morse & Co......674
900 So. Wabash Ave., Chicago, Illinois.
Air Compressors; Bearings, Axle; Cars, Hand, Inspection, Motor, Push, Section, Velocipede; Cattle Guards; Coaling Stations; Diesel Engines; Electric Light and Power Plants; Engines, Gasoline, Oil, Motor Car; Float Valves; Hoisting Machinery; Motors and Generators; Penstocks; Pumps; Scales; Track; Standpipes; Tanks; Water Columns; Water Cranes; Wheels (Hand and Motor Car); Windshields.

Fairmont Railway Motors, Inc......647
Fairmont, Minnesota.
Cars, Hand, Inspection, Motor, Push, Section, Velocipede; Discing Machine; Engines, Gasoline, Oil, Motor Car; Mowing Machine; Power Ballast Cleaner; Weed Burners.

Gas and Coke Division of Koppers Co......663-664-665-666
See Koppers Co.

General Electric Co......683
Schenectady, New York.
Arc Welders; Welding Sets; Welding Generators.

Hayes Track Appliance Co......749
Richmond, Indiana.
Bumping Posts; Derails.

Illinois Malleable Iron Company.....649
310 So. Michigan Ave., Chicago, Illinois.
Anchors; Rail; Rail Anti-Creepers.

Industrial Brownhoist.....758
Bay City, Michigan.
Buckets, Clamshell, Grab; Combination Crane Pile Drivers; Cranes, Crawler, Electric, Gantry, Locomotive, Magnet, Pillar, Transfer Tunnel, Wharf, Wrecking; Ditchers, Curb, Drainage, Open, Tile; Draglines; Excavators; Hammers, Pile Driving, Steam; Pile Drivers; Tools, Wrecking; Transfer Tables.

Ingersoll-Rand.....662
11 Broadway, New York City.
Air Compressors; Air Hoists; Air Lift Pumping System; Chipping Hammers; Compressors; Condensers; Hammers, Chipping, Calking, Riveting, Rock, Sealing; Hose; Pavement Breakers; Pneumatic Tools; Portable Grinders; Rail Bonding Outfits; Screw Spike Drivers; Tie Tampers.

Ingot Iron Railway Products Company.....661
Middletown, Ohio.
Automatic Drain Gates; Culverts; Metal Cribbing; Multi-Plate Pipe; Paved Invert Pipe; Part Circle Culverts; Perforated Pipe.

Jordan Co., O. F......755
East Chicago, Indiana.
Ballast Spreaders; Ballast Trimmers; Bank Builders; Bank Slopers; Cars, Spreader; Ditchers; Ice Cutters; Snow Plows; Spreaders.

Koppers Coal Company, the.....663-664-665-666
See Koppers Co.

Koppers Company.....663-664-665-666
Pittsburgh, Pennsylvania.
Castings, Bronze and Iron; Coal; Coal Handling Plants; Coal Washing Systems; Coke; Creosote; Disinfectants; Fire Hydrants; Insecticides; Paving; Paints, Bituminous Base; Pipe; Pressure Treated Poles, Posts, Ties, Treated Timber; Rings, Packing, Piston; Roofing; Tanks; Waterproofing; Weed Killers.

Lehon Co., The.....754
44 to 45 Sts. on Oakley Ave., Chicago, Illinois.
Asphalt; Building Papers; Floor Coverings; House Lining; Insulating Papers; Roofing, Asphalt, Composition; Shingles, Asphalt, Composition; Waterproofing Fabrics.

Lufkin Rule Co......759
Saginaw, Michigan.
Gages, Measuring; Rules; Scales, Tape; Tapes, Measuring.

Lundie Engineering Corporation, The.....671
19 West 50th St., New York City.
Rail Anchors; Tie Plates; Rail and Flange Lubricator.

Maintenance Equipment Co......677
80 East Jackson Blvd., Chicago, Ill.
Ballast Screens; Ballaster, Power; Car Stop, Friction; Derrick Cars; Flange Lubricators; Rail Layers; Switchpoint Protectors; Tie Spacers; Tools, Track.

Mall Tool Company.....760
7746 So. Chicago Ave., Chicago, Illinois.
Grinders, Rail.

Maryland Drydock Co., The.....663-664-665-666
See Koppers Co.

Master Builders Co., The.....673
71 & Euclid Avenues, Cleveland, Ohio.
Gunned Mortar, Grouts.

Metal & Thermit Corporation.....670
120 Broadway, New York City.
Thermit Welding.

Morrison Metalweld Process, Inc......660
Morrison Building, Buffalo, N. Y.
See Morrison Railway Supply Corp.

Morrison Railway Supply Corp. 660
Morrison Building, Buffalo, New York.
Rail Welding; Switch Point Guards; Portable Heater; Wood Preservation.

National Carbide Corporation 760
60 East 42nd Street, New York City.
Calcium Carbide; Carbide Lamps; Lights.

National Lead Company 763
111 Broadway, New York City.
Red Lead.

National Lock Washer Company, The 648
Newark, New Jersey.
Lock Washers; Nut Locks; Spring Washers.

Nordberg Mfg. Co. 657
Milwaukee, Wisconsin.
Adzing Machines; Bolt Tighteners; Power Jacks; Rail Drills; Rail Grinders; Spike Pullers; Track Cranes; Track Shifter; Track Wrenches.

Ohio Electric Mfg. Company, The 758
5905 Maurice Ave., Cleveland, Ohio.
Magnets.

Oxweld Railroad Service Company, The 650-651
230 No. Michigan Ave., Chicago, Ill.
Acetylene, Dissolved; Calcium Carbide; Gas, Acetylene, Gas Products; Generators, Acetylene, Carbic; Oxygen; Oxy-acetylene, Cutting and Welding Equipment; Torches, Oxy-acetylene Cutting, Welding and Heat Treating.

P. & M. Co. 642
80 East Jackson Boulevard, Chicago, Illinois.
Rail Anchors; Rail Anti-Creepers.

Peerless Manufacturing Co. 755
1400 W. Ormsby Ave., Louisville, Kentucky.
Gauge Rods; Reflex Switch Lamps.

Pettibone-Mulliken Co. 679
4710 W. Division St., Chicago, Illinois.
Crossings, Permanent Base; Mechanical Switchman.

Porter, Inc., H. K. 752
Everett, Mass.
Cutters.

Portland Cement Association 667
33 West Grand Ave., Chicago, Ill.
Cement; Concrete Piles; Precast Concrete; Trestle Deck Slabs.

Q & C Co. 688
90 West St., New York City.
Derails; Electric Snow Melters; Fence Posts; Fences; Fibre Insulation; Flangers, Snow; Guard Rail Clamps; Guard Rails; Joints, Compromise, Rail, Step; Knuckles, Emergency; Rail Benders; Rail Braces; Replacers, Car; Saws, Portable Rail; Skid Shoes; Snow Melting Devices; Snow Plows; Stands, Switch & Target; Thawing Outfits; Tie Plate Clamps; Track Insulation; Tools, Track; Ventilators; Weed Killer.

Rail Joint Co., Inc., The 676
165 Broadway, New York City.
Compromise Joints; Insulated Rail Joints; Rail Joints; Step Joints.

Railroad Accessories Corporation 645
405 Lexington Ave., New York City.
Drills, Rail; Power Track Machine; Tie Boring Machine.

Rails Co., The 764
178 Goffe St., New Haven, Connecticut
Track Construction; Track Fastenings.

Railway Maintenance Corporation 678
Freeport Road, Pittsburgh, Pennsylvania.
Moles, Ballast Cleaning; Rail Joint Lubricators.

Railway Track-work Co. 752
3132-48 East Thompson Street, Philadelphia, Pennsylvania.
Cross Grinders; Track Grinders.

Ramapo Ajax Corporation 654-655
230 Park Avenue, New York City.
Crossings; Frogs; Guard Rails; Guard Rail Clamps; Manganese Track Work; Rail Braces; Rail Expanders; Switches; Switchstands and Fixtures.

Russell Snow Plow Company 757
Ridgeway, Pennsylvania.
Snow Plows.

Simmons-Boardman Publishing Co. 672-680-754-760
105 West Adams Street, Chicago, Illinois.

Sperry Rail Service 747
Brooklyn, New York
Detector Rail; Rail Welding.

Standard Equipment, Inc. 745
70 East 45th Street, New York City
Rail Joints.

Stonhard Company 757
1323 Callowhill St., Philadelphia, Pennsylvania.
Concrete Resurfacer; Resurfacing Compound.

Stulz-Sickles Co. 758
134-142 Lafayette St., Newark, New Jersey.
Welding Electrodes.

Taylor-Wharton Iron and Steel Co. 753-756
High Bridge, New Jersey.
Castings; Crossings, Rail; Derails; Frogs; Guard Rails; Guard Rail Clamps; Joints, Rail; Manganese Track Work; Rail Braces; Switches; Tongue Switches; Track Work, Special.

Tar and Chemical Division of Koppers Co. 663-664-665-666
See Koppers Co.

Templeton, Kenly & Co. 759
1020 So. Central Ave., Chicago, Illinois.
Jacks, Track; Rail Puller & Expanders.

Tennessee Coal, Iron & Railroad Company 652-653-751
Brown-Marx Building, Birmingham, Alabama.
See U. S. Steel Corporation Subsidiaries.

Timken Roller Bearing Company, The 656
Canton, Ohio.
Bearings, Hand Car, Journal Box, Motor, Push Car, Tapered Roller, Thrust; Castings; Steel, Electric Furnace, Open Hearth Special Analysis; Tubing, Seamless Steel.

Track Specialties Co. 760
1775 Broadway, New York City.
Bumpers, Car; Bolts; Car Stop, Friction; Derails; Foot Guards; Frogs; Gauge Rods; Guard Rail Clamps; Guard Rail Braces; Joints, Compromise. Insulated, Rail, Step; Liners, Track; Lock Washers; Mono Cars; Nails, Tie Dating & Marking; Plates, Miscellaneous; Rail Anchors; Rail Anti-Creepers; Rail Benders; Rail Braces, Rail Clips; Replacers, Car; Rail Chairs; Rail Saws, Portable; Switch Point Protectors; Switches; Switch Braces; Snow Fences; Shims; Switch Stands & Fixtures; Spikes; Screw Spikes; Screw Spike Wrenches; Tie Plates; Tools, Track; Track Barrows; Tie Rods; Ties, Steel; Tongs, Tie; Track Gauges; Track Levels.

Truscon Steel Company 686
Youngstown, Ohio.
Bunk Houses; Crossings, Highway; Parts, Shed; Platform Canopies; Slabs, Intertrack; Shop Buildings; Tool Houses; Transfer Sheds; Warehouses.

Union Carbide and Carbon Corporation 650-651
30 East 42nd Street, New York City.
See Oxweld Railroad Service Co.

U. S. Steel Corporation Subsidiaries 652-653-751
Alloy Steels; Bars; Bolts; Cement; Fencing; Fence Posts; GEO Track Construction; Guard Rails; Joint Fastenings; Nuts; Rail Joints; Rails; Screw Spikes; Sheet Piling; Steel Alloy; Steel Plates and Shapes; Structural Steel; Tee Rails; Tie Plates; Ties; Tubing; Wire and Wire Products.

United States Steel Products Company 652-653-751
60 Church Street, New York City.
See U. S. Steel Corporation Subsidiaries.

Warren Tool Corporation 675
Warren, Ohio.
Adzes; Bars; Chisels; Forgings; Mauls; Picks; Sledges; Track Tools; Wrenches.

Western Gas Division of Koppers Co. 663-664-665-666
See Koppers Co.

White Tar Company 663-664-665-666
See Koppers Co.

Wood Preserving Corporation, The 663-664-665-666
See Koppers Co.

Williams & Co., J. H. 756
75 Spring St., New York City.
Chain Pipe Tongs; Clamps; Eye Bolts; Hoist Hooks; Lathe Dogs; Thumb Nuts and Screws; Wrenches, Drop Forges, Reversible Ratchet; Vises.

Woodings Forge & Tool Co. 747
Verona, Pennsylvania.
See Woodings-Verona Tool Works.

Woodings-Verona Tool Works 747
Verona, Pennsylvania.
Adzes; Bars; Chisels; Forgings; Mauls; Picks; Rail Anchors; Sledges; Spike Pullers; Tie Tongs; Track Tools, Wrenches.

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For complete information on protecting iron and steel against corrosion, send for our free booklet, "Structural Metal Painting." It covers such subjects as conditions affecting the life of paint on metal, proper paint formulation, testing and judging the value of paint, estimating areas and costs.

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111 Broadway, New York; 116 Oak St., Buffalo; 900 West 18th St., Chicago; 659 Freeman Ave., Cincinnati; 1213 West Third St., Cleveland; 722 Chestnut St., St. Louis; 2240 24th St., San Francisco; National-Boston Lead Co., 800 Albany St., Boston; National Lead & Oil Co. of Penna., 316 Fourth Ave., Pittsburgh; John T. Lewis & Bros. Co., Widener Building, Philadelphia.

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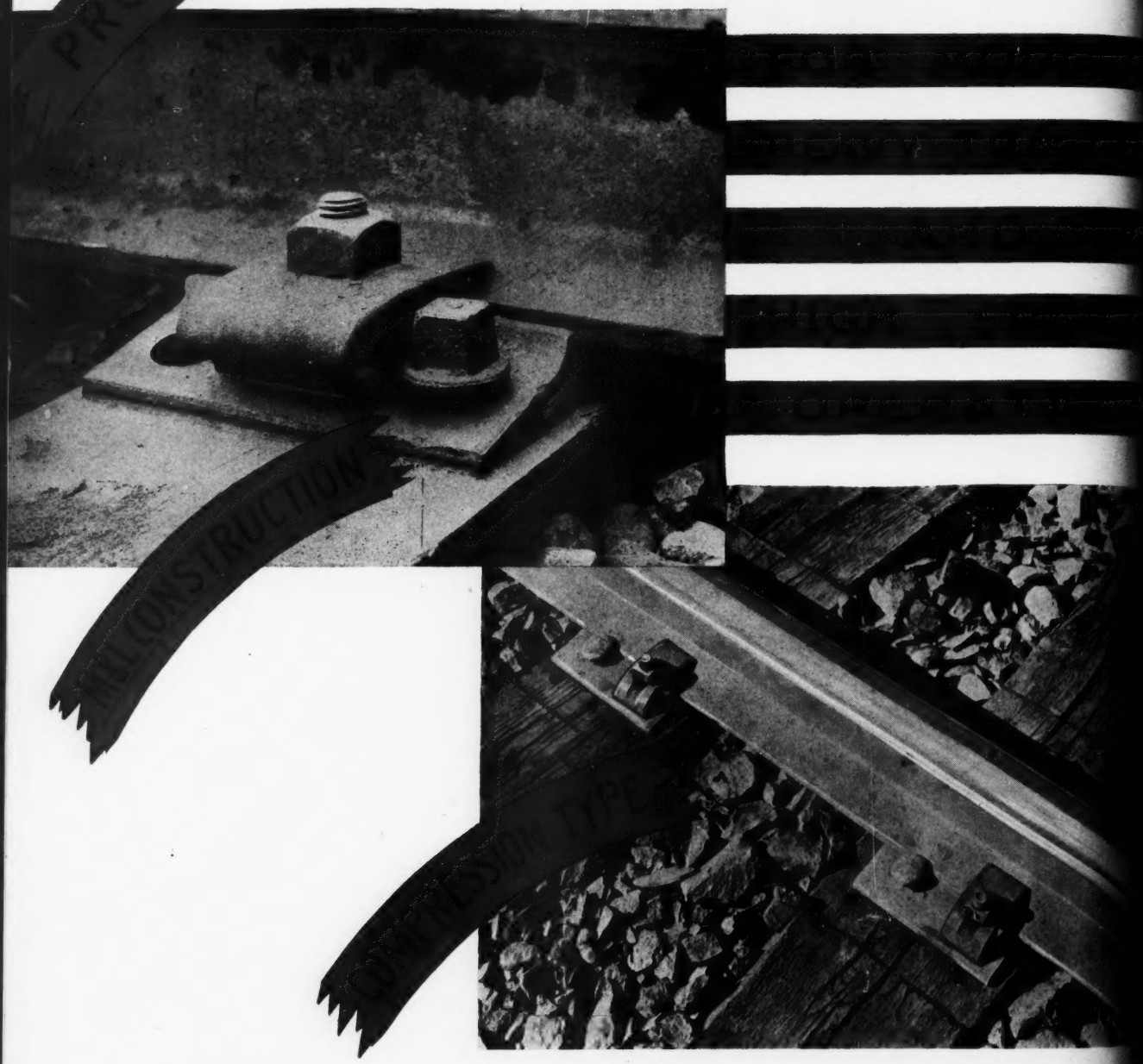

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